PSW FOREST AND RANGE
EXPERIMENT STATION
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pnw annual report 1972

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
U.S. Department of Agriculture · Forest Service · Portland, Oregon · 1973

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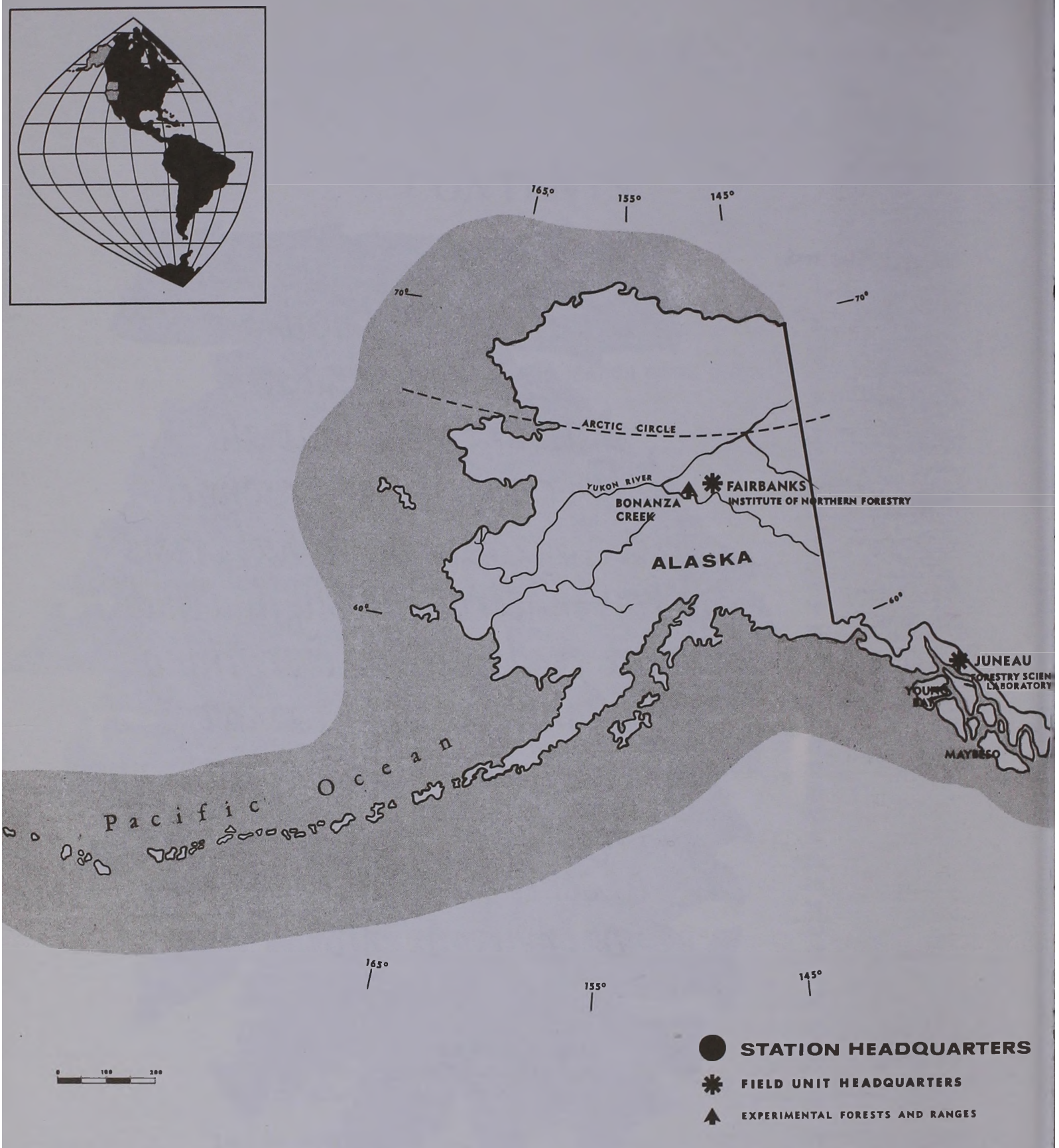
"In conclusion - let me again assure you that all Forest Service personnel recognize the national crisis in raw material supply, and that we are pledged to do everything humanly possible to meet supply need consistent with our obligations in accord with acceptable standards of environmental quality."

JOHN R. McGUIRE
Chief - U.S. Forest Service



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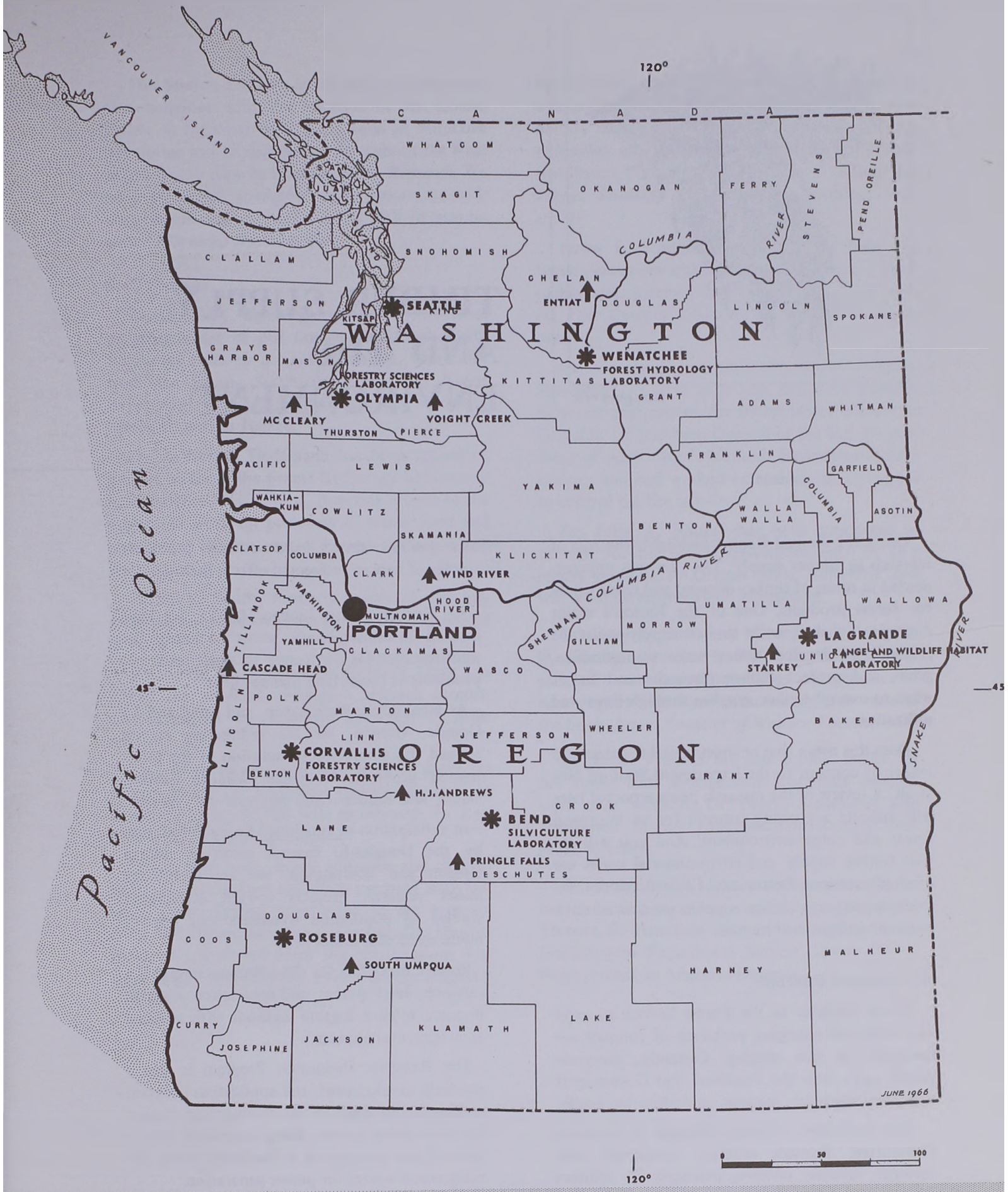


FOREST SERVICE ... U.S. DEPARTMENT OF AGRICULTURE

Douglas-fir

TIMBER SUPPLY AND THE ENVIRONMENT

Our 1972 Annual Report highlights the role of research in timber supply. The year was unprecedented in terms of timber demand and rising prices for forest products. One of the Nation's major strategies to deal with timber supply must be research—to develop better ways to reproduce, grow, and protect timber resources and better ways to extend timber supplies through improved utilization.

Does this mean that environmental issues are no longer of concern to the Experiment Station? Not at all. A review of the research items reported here will indicate a growing concern for an improved forest and range environment. And you will see that timber supply and environmental issues are often intertwined. Better use of forest residues, for example, extends timber supplies even as an environmental blight is corrected.

New Research Direction

Funds available to the Forest Service to cope with new and emerging problems of forestry are uncertain at this writing. Certainly, everyone would agree with the President that Government must be responsive, relevant, and close to people.

The Experiment Station, through its Advisory Committee, through citizens' comments, and through internal reviews, attempts to redirect efforts toward timely and critical problems. Examples of new or redirected efforts include:

—At Fairbanks and Juneau, Alaska, we have created interdisciplinary teams to study the multiresource (as contrasted to single resource) problems of forest land management.

—At Wenatchee, Washington, and Bend and La Grande, Oregon, we are redirecting efforts toward the simultaneous solution of the interrelated problems of range, wildlife habitat, water, and timber—truly multiple use research.

—In anticipation of continued heavy defoliation by the Douglas-fir tussock moth in eastern Oregon and Washington, we are mobilizing insect research projects toward accelerated studies of population dynamics and control methods of that insect pest.

—Project FALCON (in the planning stages) is a research, development, and application program directed toward logging methods with reduced environmental impacts.

—The Residues Reduction Program is also a research, development, and application program seeking better ways to use or otherwise dispose of forest wood wastes. Being completed now as part of the program is a feasibility study for using wood wastes for power generation.

The Station has now strengthened its information activities with the addition of Ms. Louise Parker as Information Officer. Soon an attractive newsletter will be distributed throughout the West called *What's New In Western Forest Research.* We need to further strengthen communications with cooperators and the news media and to put research in a more digestible form.

Staff Changes

Dr. Donald C. Schmiege returned to Juneau as program leader of our newly constituted multifunctional research project. Schmiege, who came from the Pacific Southwest Forest and Range Experiment Station in Berkeley, had formerly been stationed at Juneau.

Dr. Arthur R. Tiedemann has been appointed project leader at the Forest Hydrology Laboratory in Wenatchee, Washington, directing efforts of the project to work on problems of water yield and quality and erosion control in eastern Oregon and Washington.

Justin L. Smith, formerly leader of our big-game habitat research project at La Grande, retired in June.

At Seattle, Washington, Dr. Roger N. Clark, has joined the wildland recreation research project, specializing in the incentive approach to litter control.

Dr. Hank Gratkowski has stepped down as project leader for brushfield reclamation work at Roseburg to devote full time to research. Dr. Ron Stewart is acting project leader.

There have been several additions and changes in the forest residues reduction program since last year. Owen Cramer transferred to the program from the Pacific Southwest Station; Dr. Stewart Pickford transferred from the Southeastern Station. Hugh McLean, from Forest Service Region 3 Fire Control, replaced John Dell. Dr. Tom Adams was assigned from PNW Station's marketing economics unit; and Eldon Estep, a forest products utilization specialist of the Forest Service's State and Private Forestry program, came to us from the Forest Products Laboratory at Madison, Wisconsin.

James L. Stewart became project leader for forest disease research at Corvallis. Stewart, a plant pathologist, formerly headed the Alexandria Forest Pest Control Zone office in Pineville, Louisiana.

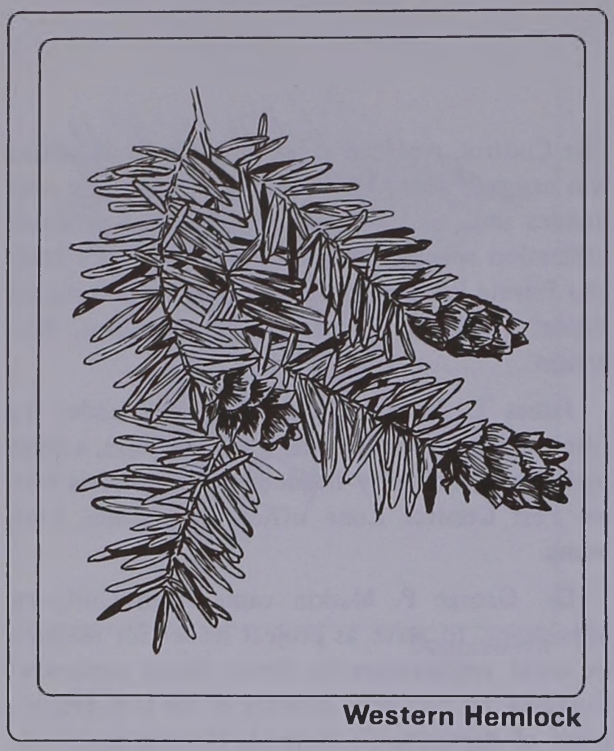
Dr. George P. Markin came from Gulfport, Mississippi, to serve as project leader for research in aerial applications for forest insect control at Corvallis. He had been director of the U.S. Department of Agriculture's Methods Development Laboratory and had worked extensively in a program to control the fire ant.

Dr. John A. Neisess has been appointed as chemist for the aerial applications unit; he is a recent graduate of Oregon State University and will work on chemistry of insecticides.

Dr. Gary E. Daterman has replaced Valentine M. Carolin as project leader in the research unit assigned to studies of physiology and behavior of forest insects. Mr. Carolin is assisting in revision of the book, *Insect Enemies of Western Forests.*

Dr. Roger Fight is the new project leader for our forest land management economics research work unit, replacing Dr. Dennis Schweitzer who transferred to the Intermountain Station, Missoula, Montana.

Dr. David R. Darr is now acting project leader for marketing economics research, replacing Dr. Thomas E. Hamilton who is transferring to the Northeastern Experiment Station, Upper Darby, Pennsylvania, as Assistant Director.



Western Hemlock

STATION ADMINISTRATION STAFF RESEARCH WORK UNITS AND SCIENTISTS—1972

Robert E. Buckman, Director

FALCON PLANNING

Flora, Donald F., Acting Program Manager (P)[1]
Clarke, Edward H., Asst. Program Mgr. (P)
Gonsior, Michael J., Intermountain Area Rep. (P)

BIOMETRICS

Johnson, Floyd A., Station Biometrician (P)
Hazard, John W., Prin. Biometrician (P)

TIMBER AND WATERSHED MANAGEMENT RESEARCH—DOUGLAS-FIR REGION

ROMANCIER, ROBERT M., Asst. Director (P)

1201 Seeding, Planting, and Nursery Practices in the Pacific Northwest

Stein, William I., Project Leader (P)
Edgren, James W., Plant Ecologist (P)
Owston, Peyton W., Plant Physiologist (C)

1204 Culture of Mixed-Conifer Forests, West-Side Cascades

Ruth, Robert H., Project Leader (C)
Franklin, Jerry F., Prin. Plant Ecologist (C)
Herman, Francis R., Mensurationist (C)
Minore, Don, Plant Ecologist (C)

1206 Brushfield Reclamation, Prevention, and Ecology

Stewart, Ronald E., Acting Project Leader (R)
Gratkowski, Henry J., Prin. Plant Ecologist (R)

1207 Intensive Culture of Douglas-fir and Associated Species

Miller, Richard E., Project Leader (O)
Reukema, Donald L., Prin. Silviculturist (O)
Williamson, Richard L., Mensurationist (O)

1208 Control of Animal Damage to Western Conifers

Crouch, Glenn L., Project Leader (O)
Dimock, Edward J., II, Prin. Silviculturist (O)
Radwan, M. A., Prin. Plant Physiologist (O)

1401 Breeding Pacific Northwest Trees

Silen, Roy R., Project Leader (C)
Campbell, Robert K., Prin. Plant Geneticist (C)
Copes, Donald L., Prin. Plant Geneticist (C)
Sorensen, Frank C., Prin. Plant Geneticist (C)

1602 Soil Stabilization and Runoff Regulation in Conifer Watersheds of Western Washington and Oregon

Rothacher, Jack S., Project Leader (C)
Dyrness, C. Theodore, Prin. Soil Scientist (C)
Fredriksen, Richard L., Soil Scientist (C)
Swanston, Douglas N., Geologist (C)

1603 Chemicals in the Forest Environment

Norris, Logan A., Project Leader (C)
Bollen, Walter B., Prin. Soil Microbiologist (C)
Moore, Duane G., Soil Scientist (C)

FOREST ENVIRONMENT RESEARCH—PEOPLE AND FOREST RESOURCES

TARRANT, ROBERT F., Asst. Director (P)

1203 Silviculture of Western Forest Types

Dahms, Walter G., Project Leader (B)
Cochran, Patrick H., Prin. Soil Scientist (B)
Barrett, James W., Silviculturist (B)
Seidel, Kenneth W., Silviculturist (B)

1601 Water Yield—Improvement and Erosion Control—Mid-Columbia River Basin Forests

Tiedemann, Arthur R., Project Leader (W)
Fowler, William B., Prin. Meteorologist (W)
Helvey, Junior D., Prin. Soil Scientist (W)
Lopushinsky, William, Prin. Plant Physiologist (W)
Klock, Glen O., Soil Scientist (W)

1652 Ecology of Southeastern Alaska Forests

Schmiege, Donald C., Program Leader (J)
Harris, Arland S., Prin. Silviculturist (J)
Meehan, William R., Prin. Silviculturist (J)
Farr, Wilbur A., Mensurationist (J)
Hard, John S., Entomologist (J)
Torgersen, Torolf R., Entomologist (J)

1701 Ecology and Management of Forest and Related Ranges in the Pacific Northwest

Garrison, George A., Project Leader (L)
Geist, Jon M., Soil Scientist (L)
Strickler, Gerald S., Plant Ecologist (L)

1801 Big-Game Habitat Research

Garrison, George A., Acting Project Leader (L)
McConnell, Burt R., Prin. Plant Ecologist (L)
Skovlin, Jon M., Prin. Range Scientist (L)
Dealy, J. Edward, Plant Ecologist (L)
Edgerton, Paul J., Assoc. Plant Ecologist (L)

1901 Wildland Recreation Uses and Social Interaction

Hendee, John C., Project Leader (S)
Clark, Roger N., Recreation Resource Specialist (S)
Potter, Dale R., Assoc. Recreation Resource Specialist (S)

1902 Cooperative Forest Recreation Research—University of Washington

Wagar, J. Alan, Project Leader (S)

FOREST PROTECTION RESEARCH; ENVIRONMENTAL SYSTEMS—INTERIOR ALASKA

WRIGHT, KENNETH H., Asst. Director (P)

1651 Ecology and Management of the Taiga (Subarctic Forests)—Interior Alaska

Cushwa, Charles T., Program Leader (F)
Beckwith, LeRoy C., Prin. Entomologist (F)
Helmers, Austin E., Prin. Research Forester (F)
Viereck, Leslie A., Prin. Botanist (F)
Zasada, John C., Prin. Silviculturist (F)
Noste, Nonan V., Assoc. Research Forester (F)

2105 Cooperative Forest Fire Science, University of Washington

Martin, Robert E., Project Leader (S)

2107 Forest Residues Reduction Systems

Pierovich, John M., Program Manager (P)
Adams, Thomas C., Prin. Economist (P)
Cramer, Owen P., Prin. Research Meteorologist (P)
McLean, Hugh R., Prin. Forester (P)
Pickford, Stewart G., Assoc. Research Forester (S)

2201 Population Ecology and Impacts of Forest Insects of the Pacific Northwest

Wickman, Boyd E., Project Leader (C)
Mason, Richard R., Prin. Insect Ecologist (C)
Mitchell, Russel G., Prin. Insect Ecologist (C)
Sartwell, Charles, Jr., Insect Ecologist (C)

2203 Diseases of Western Forest Insects

Thompson, Clarence G., Project Leader (C)
Martignoni, Mauro E., Chief Microbiologist (C)
Stelzer, Milton J., Prin. Entomologist (C)
Hughes, Kenneth M., Entomologist (C)

2204 Physiology, Behavior and Genetics of Forest Insects of the Pacific Northwest

Daterman, Gary E., Project Leader (C)
Carolin, Valentine M., Jr., Prin. Entomologist (C)
Ryan, Roger B., Prin. Entomologist (C)
Schmidt, Fred H., Entomologist (C)
Coulter, William K., Assoc. Entomologist (C)

2208 Aerial Application of Biological Agents and Other Materials for Forest Insect Control

Markin, George P., Project Leader (C)
Maksymiuk, Bohdan, Prin. Entomologist (C)
Neisess, John A., Assoc. Chemist (C)

2301 Diseases of Douglas-fir, Ponderosa Pine, and Associated Species in the Pacific Northwest

Stewart, James L., Project Leader (C)
Aho, Paul E., Plant Pathologist (C)
Harvey, George M., Plant Pathologist (C)
Knutson, Donald M., Plant Pathologist (C)

2302 Biology of Root Diseases and Soil Microorganisms

Trappe, James M., Project Leader (C)
Lu, Kuo C., Prin. Microbiologist (C)
Nelson, Earl E., Prin. Plant Pathologist (C)
Zak, Bratislav, Prin. Plant Pathologist (C)
Li, Ching-Yan, Assoc. Microbiologist (C)

RESOURCE ECONOMICS, PRODUCTS, AND ENGINEERING RESEARCH

FLORA, DONALD F., Asst. Director (P)

1301 Timber Measurement and Management Planning in the Northwest
Bruce, David, Project Leader (P)
Curtis, Robert O., Prin. Mensurationist (P)

3101 Timber Quality Research for Western Softwoods
Lane, Paul H., Project Leader (P)
Henley, John W., Prin. Wood Technologist (P)
Woodfin, Richard O., Jr., Prin. Wood Technologist (P)
Pong, Wee Yuey, Wood Technologist (P)
Plank, Marlin E., Assoc. Wood Technologist (P)

3501 Effective Use of Wood in Building Construction
Grantham, John B., Project Leader (S)
Heebink, Thomas B., Prin. Research Engineer (S)
Oviatt, Alfred E., Jr., Prin. Research Architect (S)

3701 Timber Harvesting Systems for the Pacific Coast Including Alaska
Lysons, Hilton H., Project Leader (S)
Carson, Ward W., Prin. Mechanical Engineer (S)
Mann, Charles N., Prin. Mechanical Engineer (S)
Peters, Penn A., Prin. Aerospace Engineer (S)
Burke, J. D., Civil Engineer (S)
Vigna, Carl P., Designer (S)

4101 Forest Survey in the Pacific Northwest
Metcalf, Melvin E., Project Leader (P)
Gedney, Donald R., Prin. Resource Analyst (P)
Berger, John M., Mensurationist (P)
Oswald, Daniel D., Resource Analyst (P)
Wall, Brian R., Economist (P)
Bolsinger, Charles L., Assoc. Mensurationist (P)

4102 Improvement of Forestry Survey Techniques–PNW
Pope, Robert B., Project Leader (P)
Farrenkopf, Thomas O., Mensurationist (P)
MacLean, Colin D., Mensurationist (P)

4103 Forest Survey for Alaska
Hutchison, O. Keith, Project Leader (J)
Hegg, Karl M., Mensurationist (J)
LaBau, Vernon J., Mensurationist (J)
Laurent, Thomas H., Assoc. Mensurationist (J)

4201 Economics of Timber Growing
Fight, Roger D., Project Leader (P)
Randall, Robert M., Economist (P)
Sassaman, Robert W., Assoc. Economist (P)

4301 Marketing Economics
Darr, David R., Acting Project Leader (P)
Austin, John W., Assoc. Economist (P)

RESEARCH SUPPORT SERVICES

PETERSEN, CHAS. J., Assistant Director (P)
Hague, Barbara R., **Operations** (P)
DiBenedetto, A. P., **Architectural and Engineering Services** (P)
Knutson, Maurice C., **Library Services** (P)
Hansen, George M., **Editing and Publication Services** (P)
Parker, J. Louise, **Information Services** (P)
Reineke, Dorothy E., **Statistical and Data Processing Services** (P)

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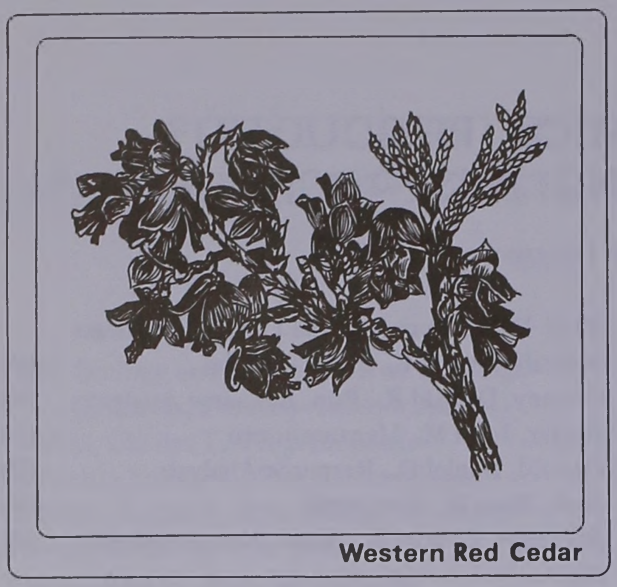
[1](P) Portland, Oregon
(B) Bend, Oregon
(C) Corvallis, Oregon
(F) Fairbanks, Alaska
(J) Juneau, Alaska
(L) La Grande, Oregon
(O) Olympia, Washington
(R) Roseburg, Oregon
(S) Seattle, Washington
(W) Wenatchee, Washington

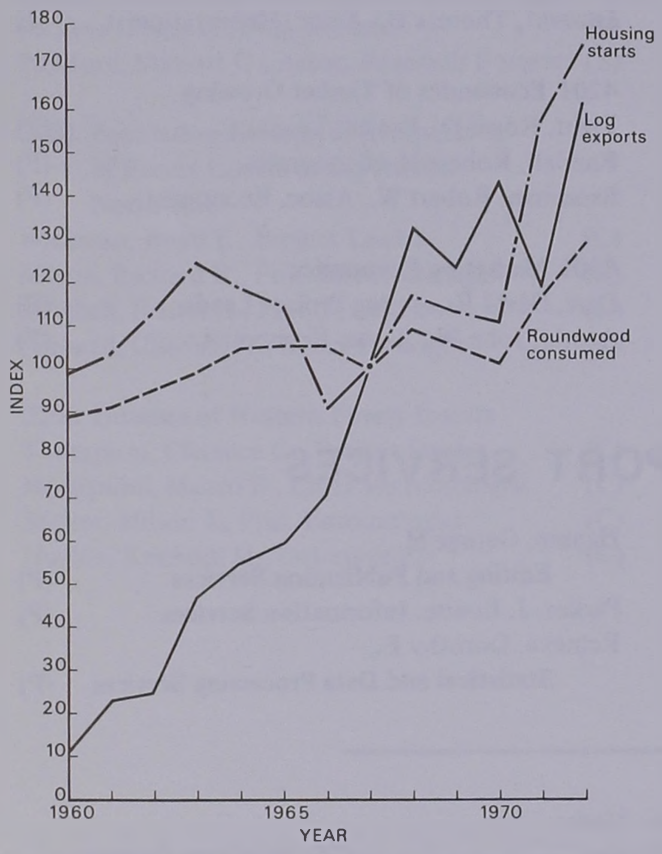


Western Red Cedar

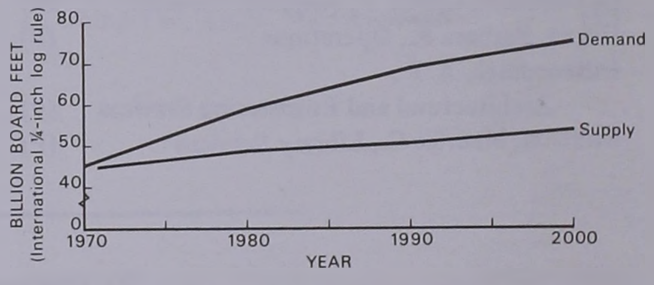
TO HOUSE THE NATION

1972 brought sharp reminders of the forest's importance in producing wood products for housing. There were more Americans than ever building homes with unprecedented vigor, pushing lumber and plywood use to record heights, paying unrivaled prices, and seeing ever-higher overseas demand for American softwood logs.

We participated in a national Forest Service review of timber supply and demand. It appears that at current prices and management intensity, demand for softwoods will rise 65 percent in the next 30 years, while supplies from U.S. forests will increase only 20 percent.



Indexes of U.S. softwood log exports, housing starts, and roundwood consumed in lumber, veneer, and plywood production, 1960-72. (1967 = 100)



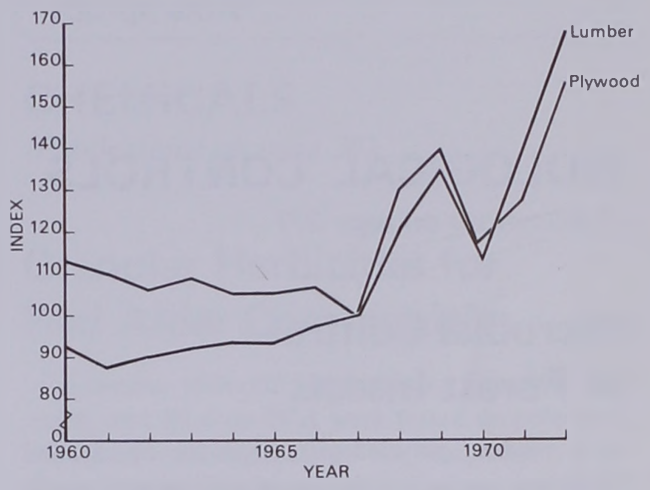
Demand and supply—U.S. forests, 1970-2000. (Source: Review draft of U.S. Forest Service report on outlook for timber in the United States. Assumes 1970 relative prices and 1970 forest management levels.)

Our Forest Survey analysts estimated that in Washington and Oregon alone, a million acres have been removed from timber production for roads, urban areas, and industry. Another one-third million acres have been put into reserved categories such as wilderness areas and National Parks.

To help produce more timber on fewer acres, the Station is seeking better solutions for problems that will lead toward greater productivity—regeneration, thinning, fertilizing, insect and disease control, genetics, fire control, and repressing competing vegetation.

Researchers are also devising ways to encourage fuller use of trees, through more efficient selling arrangements for public timber, environment-slanted logging systems, methods of predicting the best combination of products from each tree, utilization of logging residues, and economic guides to channel forestry funds into the most productive treatments. New challenges, like a Douglas-fir tussock moth outbreak and emerging logging residue reduction opportunities, required stronger and sometimes redirected research effort.

The highlights in this year's report indicate not only our determination to provide means to meet growing timber needs, but also our continued commitment to solve environmental problems.



Indexes of softwood lumber and plywood prices, 1960-72. (1967 = 100)

Sitka Spruce

SOME HIGHLIGHTS OF 1972 DEVELOPMENTS

BIOLOGICAL CONTROLS

(Publications on page 37)

Microbial Control of Forest Insects

A nuclear polyhedrosis virus for operational biological control of the Douglas-fir tussock moth appears close to realization, as a result of recent field tests on spray formulations. One improvement in formulation is the addition of an ultraviolet screening agent, which prolongs virus activity on sprayed foliage. A substantial field test involving aerial application of the virus as an alternative to chemical controls is planned for 1973.

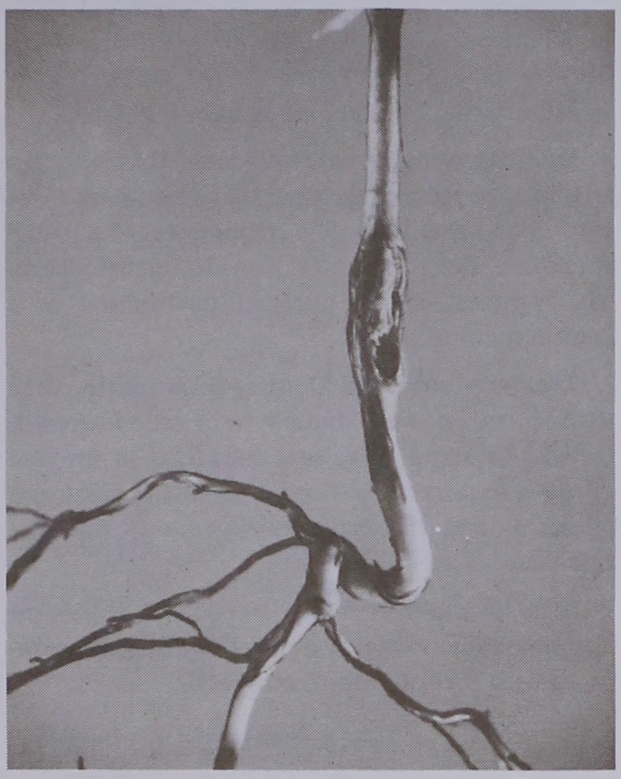
Bacillus thuringiensis, a commercially available microbial insecticide, was also found to have possibilities in biological control of forest defoliators. Small-scale field tests showed western spruce budworm, the pine butterfly, and Douglas-fir tussock moth to have a high degree of susceptibility to this bacillus, thus suggesting a second alternative for chemical control.

Douglas-fir Roots Protected by Mycorrhiza

Thelephora terrestris, a common mycorrhizal fungus in nurseries, protects Douglas-fir roots from rot caused by *Fusarium oxysporum* f. *pini*. Seedlings were grown in large flasks in the laboratory. Some were inoculated with *Thelephora* which then

Douglas-fir seedlings after 2 months exposure to *Fusarium* root rot. Left: Healthy mycorrhizae formed with *Thelephora terrestris.* Right: Stunted rootlets of nonmycorrhizal seedling.

formed mycorrhizae with the seedling roots; others were not inoculated. After 3 months, *Fusarium* was added to all flasks. Two months later, the mycorrhizal seedlings had remained healthy. The nonmycorrhizal seedlings, in contrast, had stem cankers above the root collar; many roots were decayed; and most living rootlets were stunted. Inoculation of nursery soils or seedling containers with selected, highly protective mycorrhizal fungi may well provide the most dependable method for control of seedling root rots.



Douglas-fir seedling after 2 months exposure to *Fusarium* root rot. Stem canker on nonmycorrhizal seedling.

Aerial Forest Insect Control

Spray formulations were improved for control of three forest defoliators, with attention to both microbial and chemical insecticides. The microbial insecticide was *Bacillus thuringiensis,* for which spray assessment techniques have been developed. Several commercial formulations were screened in the laboratory on the basis of physiochemical properties. Two of these were selected and tested by aerial application at an airport site, using Douglas-fir tussock moth and western spruce budworm as subjects, as a prelude to a cooperative field experiment in the Northeast against the gypsy moth. Results were promising, but improved deposit coverage is needed to obtain an acceptable level of control of the gypsy moth.

The chemical insecticides investigated were experimental formulations of Zectran and pyrethrins; they were also tested against Douglas-fir tussock moth at airport sites. Results were similar to those obtained in previous extensive field tests and demonstrate the advantage of conducting this type of relatively inexpensive test prior to field experiments. Zectran was more promising than pyrethrins; however, a higher dosage and better spray coverage at feeding sites of the insect is needed for effective control.

CHEMICALS

(Publications on page 38)

Granular Herbicides for Red Alder Communities

Granular picloram, karbutilate, dicamba, bromacil, and fenuron-TCA were tested on pole-sized red alder communities at five locations in the Coast Ranges of Oregon and Washington. Herbicides were applied on four dates between mid-February and mid-May at rates varying from 0.5 to 15 pounds per acre. Results, observed 15 to 19 months later, showed that picloram and karbutilate were effective at high application rates on overstory and understory species. Dicamba was effective on red alder while bromacil and fenuron-TCA did not control any species. Picloram, karbutilate, and dicamba killed existing Sitka spruce and Douglas-fir saplings. However, in one study area, Douglas-fir seedlings planted during the first winter after treatment did not show herbicidal damage at the end of growing season.

Red alder communities occupy more than 2 million acres of high-site forest land. Liquid herbicidal formulations are commonly used to convert

much of this land to more desirable conifers. However, many species in red alder communities are resistant to these herbicides and penetration of liquid sprays through the overstory is inadequate to control understory plants. Development of economic and environmentally safe granular herbicide treatments may overcome these problems.

Current research is investigating lower application rates and combinations of granular picloram and karbutilate.

Herbicide Movement and Toxicity After Spills

Monosodium methane arsonate (MSMA) and cacodylic acid are organic arsenic containing herbicides which are injected into tree stems to thin precommercial-size stands. During handling and application, small quantities of highly concentrated herbicide fall to the forest floor. Foresters are concerned that the chemical might be available to small animals, leach to ground water, or harm soil microbes.

In leaching experiments, both MSMA and cacodylic acid moved rapidly through the forest floor but were moderately to strongly adsorbed on mineral soil. The ready movement of both MSMA and cacodylic acid from the surface of the forest floor to the soil interface is particularly important in minimizing the exposure of small animals to these herbicides. Although cacodylic acid is more mobile than MSMA in soil, it is not sufficiently mobile to pose a threat to the quality of ground water.

The rate of organic matter decomposition by soil micro-organisms is an indicator of their well-being. We measured organic matter decomposition occurring in 28 days after adding various amounts of MSMA or cacodylic acid to forest floor material and soil from three areas in Oregon and Washington. Slight reductions in organic matter decomposition occurred in both forest floor and soil treated with high concentrations of arsenic, but these are not considered to be biologically significant reductions. Arsenic concentrations in spill areas are unlikely to exceed 1,000 p.p.m., and this level poses no threat to soil micro-organisms in forest floor and soil.

Fertilization Decreases *Poria weirii*

Ripping up roots on recently harvested *Poria weirii* infection centers, followed by nitrogen fertilization, may markedly reduce the amount of *P. weirii* surviving to infect the succeeding stand.

Past experiments have indicated that nitrogen fertilization reduces the time that *P. weirii* survives in buried wood in the laboratory. Followup studies in the forest now provide further reason for optimism about nitrogen fertilization as a control method.

Two-inch cubes of Douglas-fir wood infected with *P. weirii* were buried in a second-growth Douglas-fir stand. Urea was broadcast at the rate of 600 lb./acre of nitrogen on some plots and mixed around the cubes for a rate of 600 lb./acre-ft. on others.

After 6 months, both methods of fertilization had markedly reduced survival of *P. weirii* compared with that of unfertilized plots.

	Cubes with zone lines	Cubes with viable *Poria*
	Percent	
Urea broadcast	11	2
Urea mixed in soil	0	0
No treatment	69	48

Moreover, zone line formation by the fungus was greatly impeded. Called "lines" because they appear as such on the cut surfaces of infected wood, these structures are actually envelopes of dense, dark tissue formed by the *Poria* colony around itself as protection against antagonists. If a colony in an infected root is broken apart during logging or postharvest treatment, it will be overwhelmed by antagonists unless it can form a new zone line at the exposed surface.

ECONOMICS IN FOREST MANAGEMENT

(Publications on page 38)

Thinning Stagnated Ponderosa Pine—Marginal

An economic analysis of alternatives in the management of stagnated ponderosa pine stands shows that the costs of spacing control are not recovered by returns from increased yields in timber and forage when a 5-percent cost of capital is assumed. Only when harvest regulation policies permit an immediate increase in harvesting (the allowable cut effect) and these receipts are included in the economic analysis, do any of these regimes yield returns in excess of 5 percent.

ECONOMICS IN WOOD INDUSTRY

(Publications on page 39)

Stand Diameter and Stumpage Price

A study of average stand diameter and stumpage price on three National Forests in western Washington and western Oregon showed little relationship between these two variables when stand diameter exceeded 20 inches. Stand diameter tended to account for more variation in stumpage price when timber sales included stands with an average diameter of less than 20 inches. However, other variables such as expectations of end-product market conditions and bidder competition can have an overriding influence on stumpage price.

Cost-reducing technologies specifically adapted to smaller diameter timber are being adopted by Pacific Northwest timber processors. In time, we expect a changing diameter distribution in the timber resource; and adoption of these specialized processing techniques will alter the relationship between stumpage price and average stand diameter in a timber-market area.

Because the relationship between average stand diameter and stumpage price can vary by area, evaluation of the economic feasibility of increasing timber supplies through commercial thinning should include local as well as regional market factors.

Prices for Pulpwood Drop

A survey of pulp, board, and felt mills in Washington, Oregon, and California documented prices for chips, sawdust, shavings, utility grade logs, and other pulpwood consumed by these mills during 1970-71. Prices were updated for 1972 by return calls to survey participants.

In the period 1970-71, chip prices varied widely depending on mill location and type of mill. Prices were generally highest in Washington and lowest in California, and pulpmills paid higher prices for chips than did board mills. Pulpmills paid $3 to $5 more per bone dry ton (B.D.T.) for whitewood chips than for Douglas-fir. Sawdust and shaving prices averaged $3.00 to $7.25 per B.D.T., and utility grade logs averaged from $12.50 to $23.00 per B.D.T. Whitewood utility grade logs carried a $3 to $4 per B.D.T. premium compared with Douglas-fir.

In 1972, fiberwood prices reversed an upward trend and drifted downward. With the exception of whitewoods in the Puget Sound area, this was true for all forms of fiberwood in all areas. Mills reported that the decline in prices was due to weakening pulpwood demand in 1971 and an expanding lumber and plywood market which increased mill residue supplies.

The wide range in prices indicates that the market for residues is localized, and efforts to evaluate the economic feasibility of increased residue use should consider local as well as regional market factors.

FIRE

(Publications on page 39)

Evaluating Water and Retardant Drops

PBY beginning a run to drop water on the sampling array of collection cups.

A simple, inexpensive method was developed by the Institute at Fairbanks, Alaska, to measure ground distribution patterns of water or other fire control retardants dropped from aircraft. A contour mapping computer program was used, without modification, to plot concentrations of liquid throughout the drop zone. These maps provided an efficient means to evaluate drop patterns from fire retardant aircraft. Fairbanks district, Bureau of Land Management, used the method during the 1972 fire season and became the first operational organization to quantitatively determine the capabilities of its fire retardant aircraft.

Fireproofing Residues We Can't Use

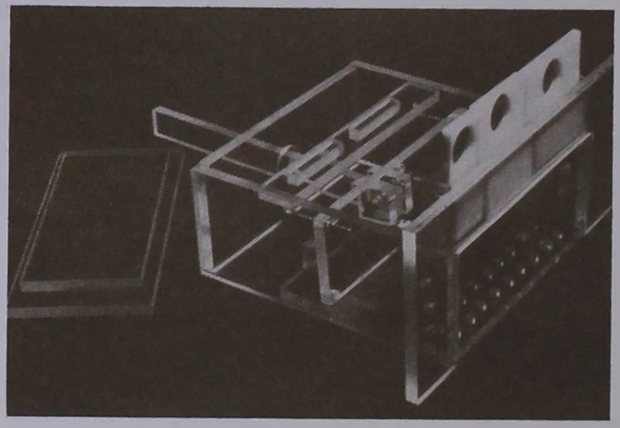
Since avoidance of conflagrations which cause drastic losses is their first concern, an initial thrust of the Forest Residues Reduction Program has been to work with land managers to this end. Five pilot test areas have been established on northwestern National Forests and a Regional (fire) Preattack Guide published by cooperative work. In the pilot test areas, we are developing improved prefire cost estimating and procedural aids and even underburning methods for standing Douglas-fir timber.

GENERAL

(Publications on page 39)

Measuring the Growth of Fish in Tanks

Growth is a good indicator of the effect of chemical or environmental stresses on fish. The usual weighing procedures for obtaining growth measurements of live fish cause significant stress, and the values are affected by the amount of water on their skin. These problems are most severe for small fish. A photographic technique of determining fish growth has been developed which reduces stress by minimizing handling and eliminating anesthetizing and blotting the fish. The area



Holding device for fish to be photographed.

of the fish image obtained from a side-view photograph is used to estimate the dry weight of the fish from a previously determined correlation between fish area and dry weight.

To obtain adequate side-view photographs of the fish, a plexiglass device was constructed which positions the fish in side view in an aquarium before a camera and electronic flash unit. The area of the fish in each photograph is measured with a polar-planimeter which is calibrated against a reference area appearing in each photograph. With this technique, the continuing growth patterns of a large number of fish in aquaria can be accurately determined with minimum stress to the fish.

Progress on Research Natural Areas

Work on the Federal system of Research Natural Areas progressed well during 1972. A major contribution was our publication of "Federal Research Natural Areas in Oregon and Washington: A Guidebook for Scientists and Educators." This book describes in detail the biological and environmental features of each of the 48 existing Research Natural Areas on Federal lands in these two States.[1] In cooperation with the Bureau of Land Management, Bureau of Sport Fisheries and Wildlife, National Park Service, and Region 6 of the Forest Service, several scientists were hired and worked under Station leadership during the summer on various aspects of the Research Natural Area program. Permanent plots and photo points were established within selected areas and new candidate areas identified.

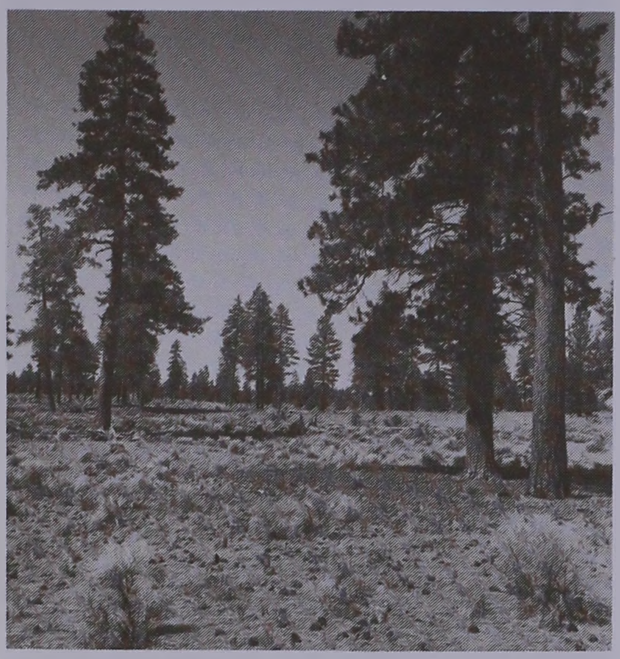
New natural areas established during 1972 included Bagby and Wheeler Creek on National Forest lands and Lost Forest on Bureau of Land Management land. Bagby provides representation of 250-year-old Douglas-fir-western hemlock forests in the western Cascades of northern Oregon. Wheeler Creek is the first Federal Research Natural Area established for the redwood forest type. This

[1] For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402. Price $3.50. Stock Number 0101-0225.

Old-growth redwoods dominate the Wheeler Creek Research Natural Area on the Siskiyou National Forest near Brookings. This Research Natural Area, the first established for redwood, provides a representation of the species as it occurs near the northern limits of its range.

Mature 250-year-old Douglas-fir-western hemlock forests characterize the Bagby Research Natural Area on the Mount Hood National Forest. This is the first Federal reserve established for this type in the western Oregon Cascade Range.

tract, on the Chetco Ranger District of the Siskiyou National Forest, includes 135 ha. (334 acres) of mixed redwood and Douglas-fir stands near the northern limits of the redwood range in southwestern Oregon. Lost Forest Research Natural Area provides scientific protection for an isolated stand of ponderosa pine located on sandy soils far out in the sagebrush steppe of central Oregon.



Bureau of Land Management's Lost Forest Research Natural Area preserves for scientific and educational purposes an isolated stand of ponderosa pine located well within the sagebrush steppes of central Oregon. Its occurrence there is a consequence of deep, sandy soils which conserve the limited moisture supply.

GENETICS

(Publications on page 41)

Good Genotypes Perform Well at All Spacings

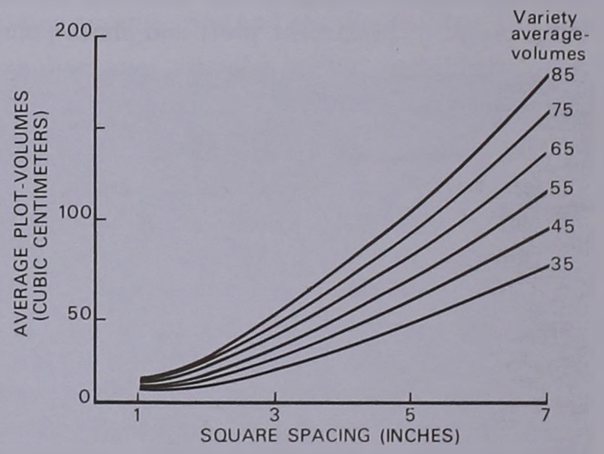
One of the concerns for tree breeding is that genotypes selected to be used in improved strains may not be superior at all spacings.

In a recent test of seedling Douglas-fir grown at four spacings, it was found that varieties of highest average wood volume per tree performed best at all spacings, i.e., a variety 50 percent better than another at the closest spacing was also 50 percent better at the widest spacing.

Evidence that results from seedling tests likely will apply to older trees comes from two sources. First, a growth model which related volume of seedlings to spacing was also found to be appropriate for 43-year-old trees. Second, the same type of variety-spacing interaction that appeared in our experiment has appeared in spacing tests involving species of such widely divergent growth types as forage herbs and grasses, grain crops, and root crops. These facts suggest that plants respond similarly to spacing regardless of type or size.

Culling to Reduce Self-pollinated Seedlings

Self-pollinated Douglas-fir plants are undesirable for reforestation because they are generally smaller and less vigorous. One of the reasons for nursery culling of small seedlings is to remove plants which have arisen from self-pollination. However, these plants are not uniformly small. They do grade into normal seedling sizes and, consequently, culling by size cannot remove them all. Optimally, such culling should remove as many of the selfs as possible without discarding too many normal plants.



Response to spacing of seedling families of different average growth potential (measured by average volume).

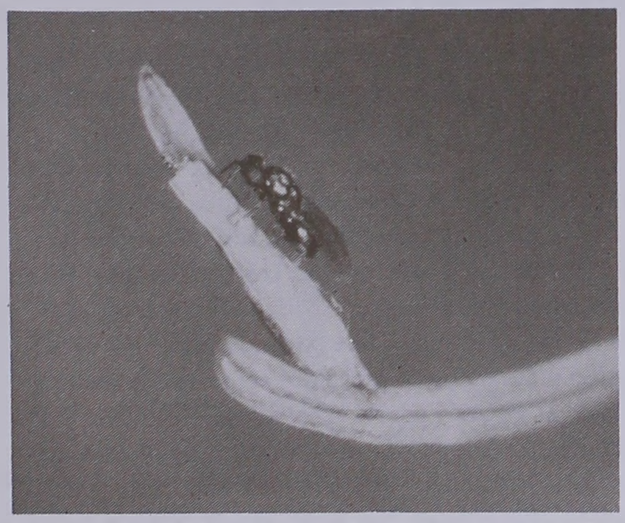
In order to study the effect of culling, we constructed two artificial nursery populations. They contained 5 and 10 percent of self-pollinated seedlings and were based on measured size distributions of pure self- and cross-pollinated progenies. These populations were then culled by removing the shortest 10, 20, 30, and 40 percent of the seedlings. Approximately 40, 60, 70, and 80 percent of the self-pollinated plants were removed from both populations at these culling levels. Thus, culling beyond 10 percent and certainly beyond 20 percent removes mostly cross-pollinated plants.

INSECTS

(Publications on page 41)

Parasites of Larch Casebearer Imported

In cooperation with the Intermountain Forest and Range Experiment Station and Regions 1 and 6 of the Forest Service, the use of insect parasites is being tested as a method for controlling an introduced pest, the larch casebearer. Starting in 1957, this pest spread quickly through western Montana, northern Idaho, and northeast Washington, where it is causing severe growth reduction of western larch. Since 1967, it has invaded 168,000 acres in southeast Washington and northeast Oregon. Its early invasions of northeast United States and Canada were effectively controlled by liberations of introduced parasites.

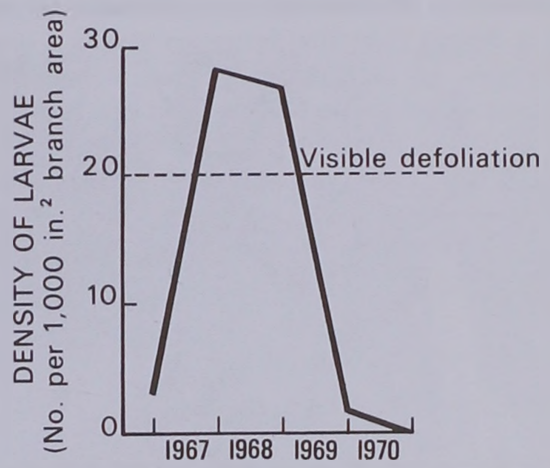


Introduced parasite, *Chrysocharis laricinellae,* exploring needle case of a larch casebearer.

In 1972 two species of parasites, *Chrysocharis laricinellae* and *Dicladocerus westwoodii*, were obtained from Austria and England through the Commonwealth Institute of Biological Control and released in infested stands in southeast Washington and northern Idaho. It is expected that these parasites will supplement the effects of a previously released parasite, *Agathis pumila,* which is showing promise in some areas. It will be several years before the results of the parasite liberation effort can be fully evaluated.

Tussock Moth Population Dynamics

Research on the present, extremely virulent Douglas-fir tussock moth outbreak in eastern Oregon and Washington confirmed findings of studies during the past several years by our scientists working on outbreaks in California and Arizona.



Population change in an outbreak of the Douglas-fir tussock moth in central Arizona.

A typical cycle of a tussock moth outbreak lasts about 3 years. Severest defoliation and damage usually come in the second year. In the third year most infestations decline naturally to a low level after causing only minor additional defoliation. If tussock moth damage is to be prevented,

incipient outbreaks must be detected and evaluated during the first year of the outbreak cycle. Effective control measures can then be initiated the second year to reduce population density before significant defoliation occurs. Knowledge of how population densities fluctuate in different environmental conditions is fundamental to predicting tree damage and developing pest management strategies.

LOGGING

(Publications on page 42)

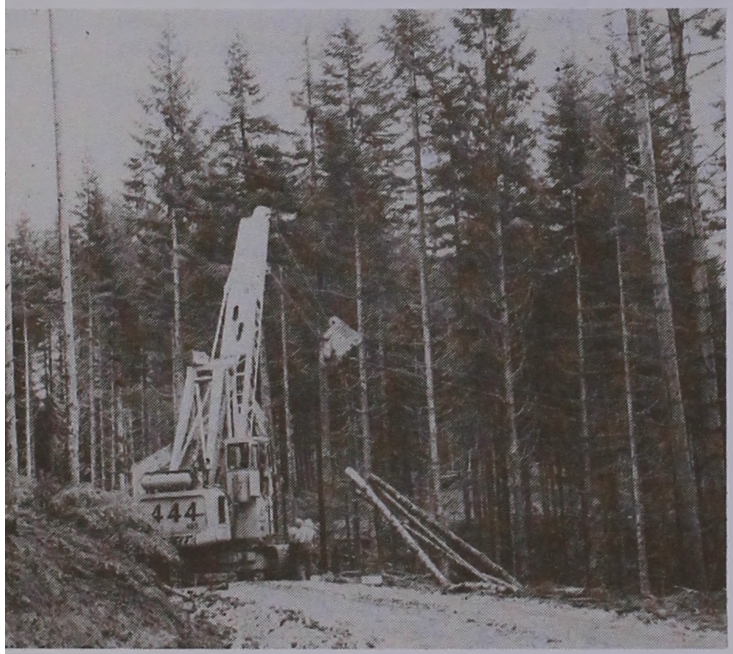
Logging Can Favor Environment

The increasing environmental restraints on logging practices are accelerating technological developments to overcome the economic impact of these restrictions.

The trend to irregular-shaped timber harvest settings dictated by landscape considerations prompted the development of a means of quickly determining the average yarding distance on non-geometric shapes via a digitizer and desk-top programable calculator. The calculator also displays the area, maximum yarding distance, and slope correction.

The emphasis on aerial logging systems, which have critical weight limitations, induced the development of a practical method of log weight estimation following light sampling. The method is suitable for any species or location.

The trend to running skylines for grapple or choker yarding results in less damage to forest environment by reducing the size of landings. To further the application of these advanced yarding systems, information was published on road and landing criteria for mobile crane yarders.



A mobile crane yarder thinning from a relatively inconspicuous landing.

MENSURATION

(Publications on page 43)

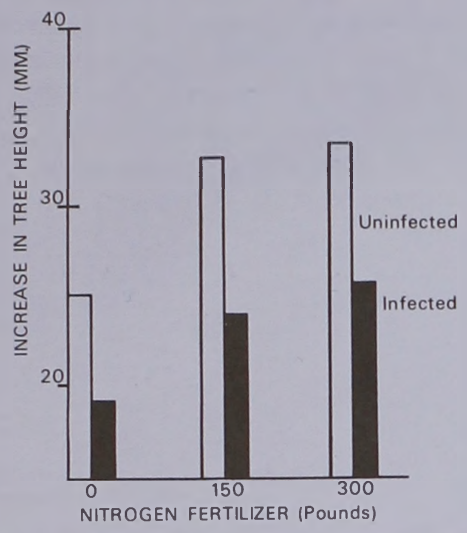
Fall, Buck, and Scale Cruising

Years of research in cooperation with the Bureau of Land Management and the Administrative Branch of the Forest Service has led to an exciting new method for cruising timber. The method calls for selecting sample trees by the now-familiar 3P sample selection procedure and for measuring these sample trees **after** they have been felled and bucked. This combination of 3P sampling and down-tree measurement has drastically reduced both sampling error and technique error. It offers Federal agencies an opportunity to sell timber lump sum and still protect the interests of the purchaser. The method has been widely tested throughout the West and is already being used on a production basis.

PATHOLOGY

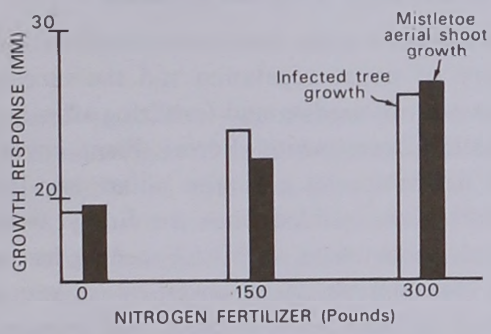
(Publications on page 43)

Dwarf Mistletoe Responds to Fertilizer



Growth response of healthy and infected ponderosa pine seedlings to three levels of N_2 fertilization.

Pine forest managers undertaking fertilization programs to increase tree growth are concerned about the effects such practice may have on disease problems, such as dwarf mistletoe. To investigate this, height growth of 2-year-old ponderosa pine seedlings infected with dwarf mistletoe and grown in cold frames was compared with height growth of healthy seedlings at three levels of nitrogren (urea) fertilization (0, 150, 300 lbs. N/acre).



Growth response of infected ponderosa pine seedlings to three levels of nitrogen fertilization and growth response of mistletoe aerial shoots to the same fertilization treatments.

Seedling height increased as level of fertilization increased. Infected seedlings grew only half as much as healthy ones at all levels of fertilization.

Dwarf mistletoe aerial shoot growth also increased proportionally to the level of fertilization, that is, the more vigorous the seedling, the more vigorous the dwarf mistletoe.

These results indicate short-term impacts on seedlings. Several more years will be needed to evaluate the long-term impact of nitrogen fertilization of dwarf-mistletoe-infected ponderosa pine.

Christmas Tree Foliage Disease

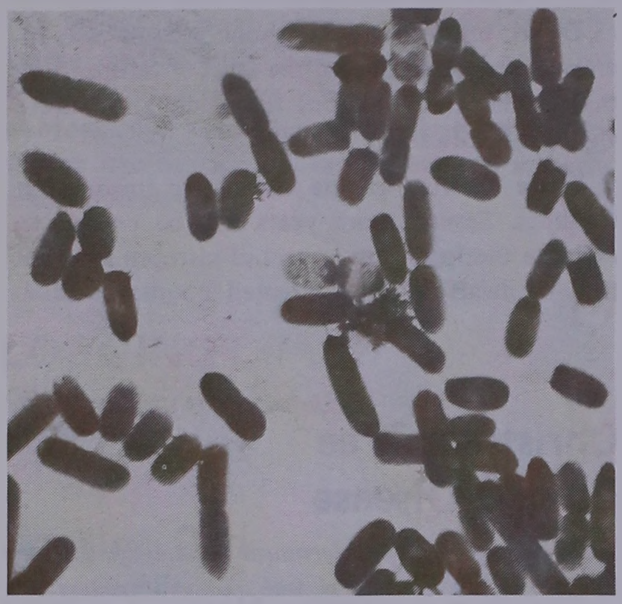
A damaging *Lophodermium* sp. foliage disease in Scots pine Christmas tree plantations has recently appeared in western Oregon and Washington. We are cooperating with Rocky Mountain Station pathologists to work out the life cycle of the organism and possible control measures. The fungus apparently originated from infected Scots pine seedlings shipped to the Northwest from infected midwestern tree nurseries.

Spore traps in a Siletz, Oregon, Scots pine plantation indicate that sporulation of the organism is closely correlated with rainy periods and is seasonal in nature. During the dry summer months, few to no spores were recorded for weeks at a time; however, with the onset of October rains, the count increased with a peak reached in early November of 1972. Spore casts have continued at a lower level through mid-December and will be monitored through the spring of 1973.

Nitrogen-fixing Bacteria Found in Decaying Wood

Station pathologists, in cooperation with Oregon State University scientists and using newly developed techniques, have discovered bacteria that fix nitrogen in decayed white fir heartwood. This finding may answer a question that has puzzled pathologists for many years. Wood is very

low in nitrogen, yet fungi require nitrogen to cause decay. Where does the nitrogen come from?



Electron photomicrograph of nitrogen-fixing bacteria (probably species of *Enterobacter)* isolated from decayed wood. 4000X

Large numbers of nitrogen-fixing bacteria were found in wood just beginning to decay. It is likely these bacteria provide the nitrogen for the decay fungi. Studies are now under way to verify this.

Such studies may lead to a more thorough understanding of the decay process and possible ways of preventing decay. Decay in Oregon and Washington causes an annual loss of 110 million cubic feet of wood. This would be enough lumber to build 61,000 average-size homes.

PHYSIOLOGY

(Publications on page 44)

Nutrient Budget of a Douglas-fir Forest

Nutrients essential to the productivity of the forest are cycled between air, trees, soil, and stream. For a 2-year period in an undisturbed, old-growth Douglas-fir forest, nitrogen was in balance in precipitation and streamflow while loss of phosphorus exceeded gain by 0.34 kilogram per hectare (0.30 pound per acre). Both these nutrients move predominantly as dissolved forms. Nitrogen loss in sediment accounted for 60 percent of the total nitrogen loss.

These data suggest that productivity of Douglas-fir forests is maintained by the efficient retention of nitrogen and phosphorus. Losses of nitrogen would be larger when catastrophic erosion events remove large amounts of soil by landslides. Because a large proportion of nitrogen is lost in sediment, control of erosion is essential in managed forests if nitrogen levels are to be kept in balance. The small phosphorus loss in the natural forest suggests that it is replaced by mineral weathering.

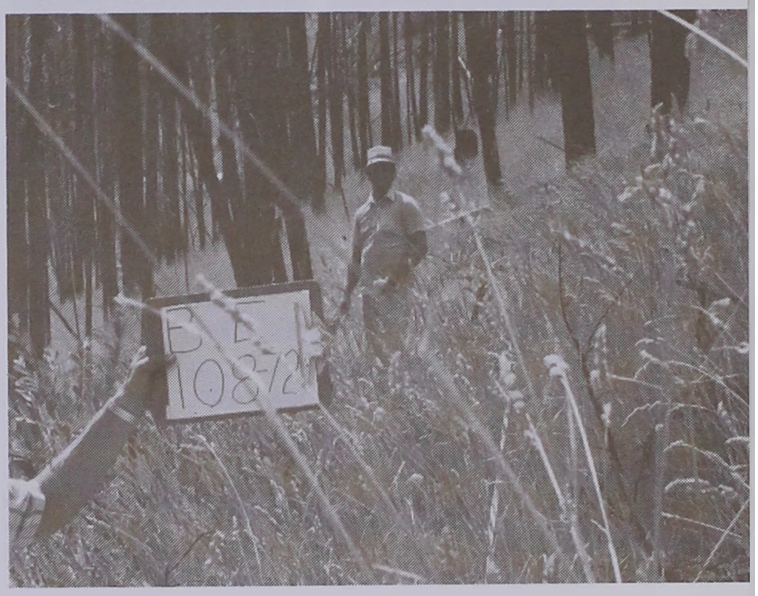
PLANT ECOLOGY

(Publications on page 44)

Seeding and Fertilizing Improve Plant Cover on Burned Watersheds

Two years of study have been completed on the recovery of native vegetation and the success of erosion control seeding and fertilizing after fire on the Entiat Experimental Forest. Plant cover, of which native species comprise about two-thirds, has more than doubled since the first-year measurements were taken. Artificial seeding has been shown to improve plant cover by as much as one-third in both years of study, but ammonium sulfate and urea fertilizers were not of benefit until the second year. Observations made the second year indicate that both ammonium sulfate

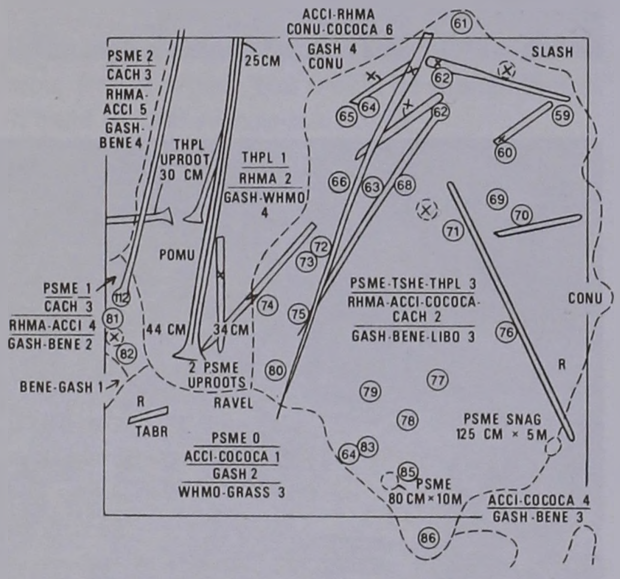
Vegetation transect on the Entiat Experimental Forest 1 week after the fire in 1970, 1971, and 1972. This transect was in a watershed that was seeded and fertilized with ammonium sulfate.



and urea fertilizers were essential to continued growth and vigor of seeded species that had become established the first year. Of five seeded species, orchard grass, hard fescue, and timothy were most successful. Perennial ryegrass and yellow sweet clover grew so poorly that they can be eliminated from the mixture, resulting in a savings of $0.50/acre on seeding costs. On the four watersheds involved in this study, this would represent a savings of $3,150.

Towards Ecologically Sound Management Decisions

The H. J. Andrews Experimental Forest has been selected as an intensive study site for the Coniferous Biome of the International Biological Program (IBP) because of our well-established, small-watershed studies and the wealth of background ecological data accumulated over the years. In cooperation with the IBP, the initial effort is the development of knowledge of water and nutrient cycling within the Douglas-fir ecosystem with emphasis on linkages between terrestrial and aquatic environments. Later, emphasis will be placed on understanding how these cycles are affected by commonly used land management practices. During the first years, studies by a number of scientists of many disciplines have been largely concentrated on one 25-acre watershed. Basic data on as many as possible of the compartments and transfers in old-growth Douglas-fir ecosystems are being developed and linked, using mathematical models. The ultimate objective is to describe the dynamics of material and energy flows in the complete ecosystem.



Detailed mapping on a 25-meter-square portion of the 25-acre watershed provides a basis for stratification and a key element in determining biomass and nutrient capital of this Douglas-fir ecosystem.

Because we have considerable data on streamflow and precipitation, hydrologic models are already being formulated. Research has begun on other elements of the ecosystem. Intensive vegetation mapping of the 25-acre watershed has been completed in unprecedented detail and will be a basis for stratification and a key element in determining biomass and nutrient capital. Japanese IBP scientists assisted in collecting a large quantity of such data on natural forests of Douglas-fir, noble fir, and western hemlock-Sitka spruce. Such information is basic to quantification of other aspects of the ecosystem such as the cycling of nitrogen and other chemicals important to site productivity, release of chemicals to streamflow, use and distribution of water within the system, and the total production and decomposition cycles of organic matter. Currently, Station scientists are working with scientists from Oregon State and other universities to develop a preliminary model describing these relationships on the intensively studied watershed. This will be verified through application to our other experimental watersheds on the South Umpqua drainage and in the Bull Run drainage near Portland. In a few years, we hope to have a basis for predicting the effects of management practices on the total system, for ecologically sound management decisions, and for a more complete understanding of how changes in one or more elements of the ecosystem will influence other elements.

Alaska Trees and Shrubs

The publication of the U.S. Agriculture Handbook No. 410, *Alaska Trees and Shrubs,* culminated several years of work. This handbook identifies the native woody plants of Alaska. The 33 species of trees and 94 species of shrubs are described in nontechnical terms and illustrated by drawings. Also included are notes on the occurrence and uses of each species and a small map showing its range. There are keys for identification in both summer and winter. A large, folded map, in color, shows the generalized types of forests and tundra.

Senator Ted Stevens and Dr. Viereck discuss use of the new book.

Prepared by the USDA Forest Service, the book is in response to the urgent need for information on the natural resources of Alaska. It will be especially useful for scientific and conservation groups, land-use planners, and all who are interested in environmental problems such as resource allocation, alteration of vegetation, and pollution control. *Alaska Trees and Shrubs* is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price $3.25.

RANGE ECOSYSTEMS

(Publications on page 45)

A Key to Managing Browse Species

Analyses of carbohydrate reserves in shrub crowns and results of simulated browsing studies help in determining and understanding the proper season and intensity of shrub use for perpetuation of the browse resources. Fall and winter browsing are less detrimental to the plant. The more damaging periods of use are late spring and mid-growing season, when carbohydrate reserves are lower. Intensity of use which different species can tolerate is quite variable and may be related to magnitude of reserves as well as morphology of each species.

Most carbohydrate storage in browse species seems to be in the smaller roots, and next greatest in oldest portions of crowns. Browsing animals prefer and use the young portions of crowns and thus do not normally remove the major carbohydrate storage areas. This finding may in large part account for the remarkable tolerance of particular rangeland shrubs to browsing by big game and livestock.

Damaged Subalpine Rangelands Heal Slowly

Aiding subalpine rangeland recovery. Left—1907; right—1972.

In 1905, great areas of depleted subalpine grasslands in the Wallowa Mountains of eastern Oregon were allotted to the Forest Service for management. In 1907, Dr. Arthur W. Sampson, pioneer plant ecologist, was hired by the Forest Service to study these important range-watersheds and recommend procedures for their improvement. Sampson initiated grass reseeding studies

and proposed modification of grazing management for the areas.

Formal remeasurements of Sampson's original study plots were begun in 1955. They show that maximum recovery and dominance of green fescue occurred only on or around remnant stands. Secondary plant succession on eroded and barren areas was apparently aided by introduced species trials of 1907. Even though these introduced species are not present today, Sampson's plots now have 50 to 80 percent as much ground cover of native vegetation as those which regenerated from remnant stands of green fescue. Apparently, plant succession on these eroded and barren areas was aided by the introduced species trials. However, ground cover on unseeded and unstable plots is so inferior that they are being invaded by white bark pine and subalpine fir trees.

RECREATION

(Publications on page 45)

What Happens to Litterbags?

One might assume that litterbags provided in recreation areas will be used for litter disposal and that, through their use, the amount of litter on the ground will decrease. However, a study conducted in Mount Rainier National Park indicated that only a very small proportion of the litterbags handed out were put in Park trash cans. Furthermore, most of the remaining unused litterbags were carried away unused. This study indicates that litterbags may be used to dispose of waste material which otherwise might end up on the ground (garbage), but they do not by themselves encourage litter pickup.

Incentives for Controlling Litter

Recreation research in Seattle, Washington, was given a merit award this year by the Keep America Beautiful organization for its innovative research on litter control through the use of incentives. The incentive system, developed over 3 years of experimentation, has proven to be extremely effective and well liked by campground rangers and the public. The system rewards children and adults who pick up litter in specified areas. Rewards include educational items such as patches, badges, posters, and bookcovers available from the Smokey Bear fire prevention campaign and the Woodsy Owl anti-pollution campaign.

During 1972, rangers in six districts on three National Forests in Washington and Oregon used the incentive procedures to control their litter problem in campgrounds and some dispersed recreation areas. Future plans call for extended use of the program in other recreation areas in the two States. Several other local, State, and Federal agencies have expressed interest in the program and, hopefully, will use a similar approach in conjunction with other litter control efforts.

REGENERATION

(Publications on page 46)

Pine Seedlings Storage and Field Survival

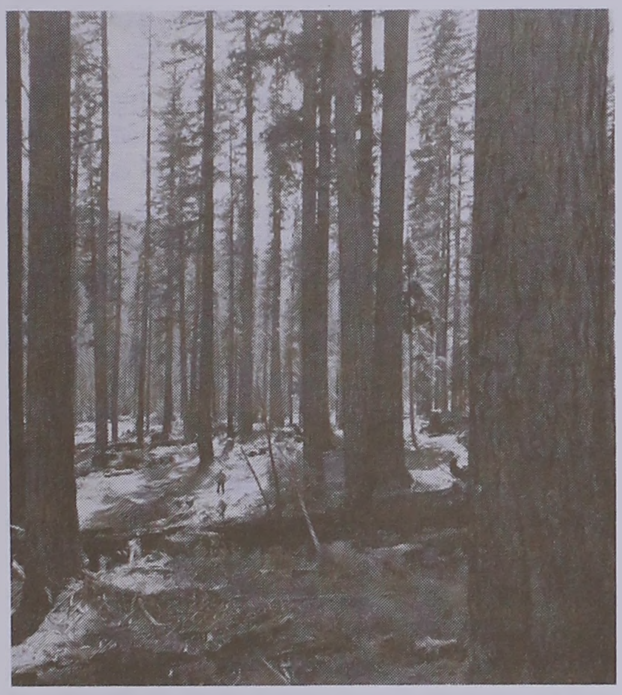
Often tree seedlings are held in cool storage for a limited period between lifting at the nursery and planting in the field. When extended, such storage materially affected survival of ponderosa pine planted on two sites in southwestern Oregon. One year after planting in early April, pine survival was best, 57 percent, for trees planted immediately after lifting; and poorest, 18 percent, for those stored 19 weeks. Survival was intermediate for

trees subjected to a combination of storage and holding in soil trenches at the nursery for 19 weeks. Clearly, ponderosa pines should not be subjected to lengthy storage if destined for planting on difficult sites.

Douglas-fir Regenerates Under Shelterwood

There is currently much interest in examining alternatives to clearcutting in coastal Douglas-fir. This interest arises from silvical and environmental concerns. Examination of 21 operational shelterwood harvests at high elevations in the western Oregon Cascade Range showed that such harvests lead to satisfactory stocking of natural regeneration within 2 to 3 years after harvest. Where seedbed preparation was adequate, Douglas-fir seedlings were in about the same proportion as in the overstory. Without adequate seedbed preparation, seedlings of other species outnumbered Douglas-fir seedlings about 2½ to 1.

Overstory survival was good, averaging 98 percent of the initial residual number of trees. Mortality was greater (maximum 17 percent of number of trees) in several units where overstory density actually fell within the seed-tree category. Within the feasible range of shelterwood densities for Douglas-fir, greater shelterwood densities are recommended for southerly slopes than for northerly and for severe sites than for mesic.



Natural regeneration is satisfactory under this shelterwood stand in typical old-growth timber in southern Oregon.

Heat-induced Germination of Scotch Broom Seeds

Scotch broom is spreading on forest lands at low elevations west of the Cascade Range. The shrubs suppress young conifers by shading and competing for soil moisture during the dry seasons. Preliminary studies indicated that scotch broom seeds are anatomically similar to *Ceanothus* seeds, which germinate after exposure to high soil temperatures. A laboratory-greenhouse experiment has demonstrated that dormant scotch broom seeds in forest soils can also be induced to germinate by heat of wildfires or logging slash fires.

Soil temperatures of 45° C. or less did not cause the seeds to germinate. A few seeds germinated after exposure to 60° C. soil temperatures, but maximum germination was obtained from seeds buried in soil heated to 90° C. Duration of exposure from 4 minutes (minimum) to 40 minutes (maximum) had little effect on germination at soil temperatures up to 90° C. Mortality occurred in seeds exposed to 105° C. soil temperatures, and number of seeds killed increased with length of exposure. Exposure in soil heated to 120° C. killed all scotch broom seeds of the seed sample tested. A total of 7,000 seeds were involved in this experiment.

Germination can occur from soil temperatures generated during burning of light logging slash or when burning chemically killed brush to prepare sites for reforestation. Greater amounts of slash would raise soil temperatures to lethal levels.

Performance of Containerized Seedlings

Pulling a "plug" seedling from the 4½-inch-deep cavity in a Styroblock used for greenhouse production of Douglas-fir.

Vigorous, uniform container stock can now be grown in a few months on a variable greenhouse schedule and be available at optimum times for outplanting on particular sites. First-season results suggest that "plug" seedlings have both advantages and limitations compared with conventional bare-root nursery stock.

Survival of Douglas-firs grown in Styroblock containers and planted as "plugs" on clearings in southwestern Oregon varied substantially by aspect. On north aspects, survival was slightly higher for container-grown stock than for 2-0 or 1-1 bare-root stock. On south aspects, where survival of all stocks was substantially lower, survival of container stock was lowest. It appears that small container stock may prove very useful on favorable sites but should not yet be relied on to reforest the more unfavorable sites.

COMPARATIVE FIRST-SEASON SURVIVAL OF DOUGLAS-FIR

Type of Stock	Survival by aspect	
	North	South
	Percent	
Containerized	86	49
2-0 seedlings	84	55
1-1 transplants	77	62

RESIDUES

(Publications on page 47)

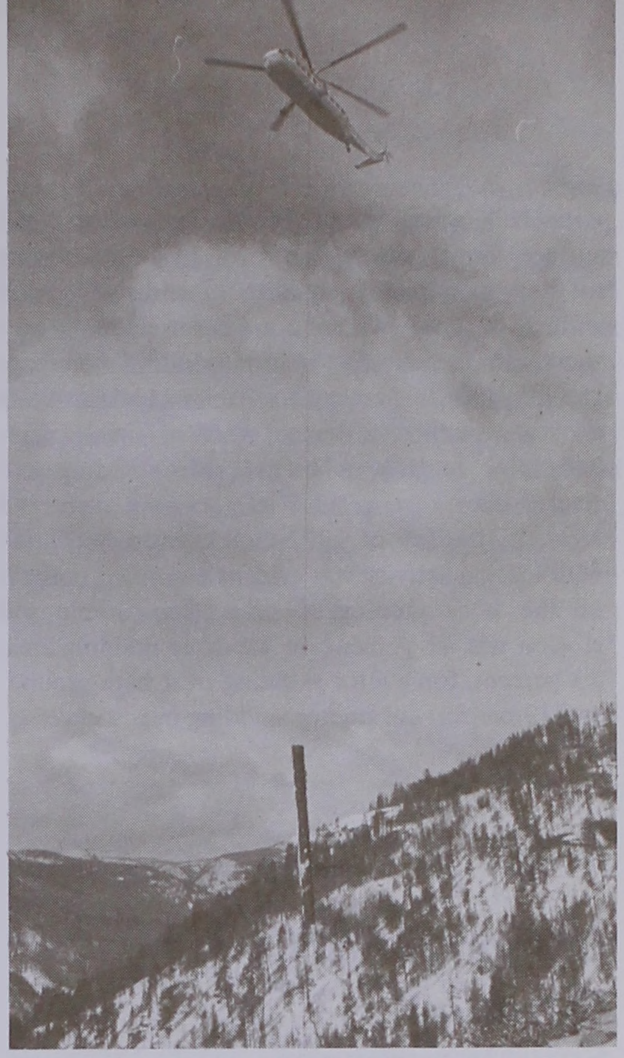
Estimating Residue Volumes on Specific Tracts

Extensive surveys have established that logging residues have the potential for supplying substantial amounts of wood for fiber production. These surveys have provided information on the total volume of residues, their distribution by owner class and geographical area, by diameter and length classes, and by relative suitability for pulping. However, good management of residues requires that the land manager have some means of quickly and accurately determining the amount and characteristics of residues left on a specific tract and of estimating the volume of residues likely to be produced prior to actual harvest.

We are currently designing a study to determine the relationship between logging residues and (1) stand factors such as age, species, and defect; (2) terrain factors such as slope, roughness, and elevation; and (3) economic factors such as type of purchaser, distance to processing plant, kind of sale arrangement, and general price picture of wood products. A primary need for such a study is a method of determining with confidence the volume of residues actually associated with these variables. We have been developing an efficient and accurate sampling technique applicable to harvesting operations on the west coast. The results indicate that the line intersect method combined with a systematic grid sampling design will produce valid estimates for a specific tract. Three configurations of sample line transects were tested, and the analysis gives an estimate of the number of sample units needed to achieve given levels of precision for each.

Increasing Wood Resource Through Use of Residues

In an examination of management alternatives, the Station's Forest Residues Reduction Program has concluded that residue reduction through increased use of wood fiber: (1) is likely to increase and be most influenced by shrinking timber supplies relative to demand for wood products; (2) might come in time, due to increase in timber demand, from public reaction to environmental pollution resulting from processing of competing materials; (3) will require incentives for logger and processor for residues to be received at an accelerated rate in a given locality. A trade-off of reduced revenue to obtain a cleaner site for forest regeneration is consistent with intensive forest management and suggests a change in the timber seller's emphasis from maximum initial revenue to that of replacing the harvested stand with a site ready for regeneration. Feasibility analyses through simulation and examination of market expansion opportunities are in progress which should indicate to landowners the kinds of residues to remove and the processes which should be encouraged. Priority in this work has been directed toward the growing needs for energy and raw materials.



Helicopter logging after fire, Entiat Experimental Forest.

Tractor logging on snow, after fire on Ential Experimental Forest.

SOILS, SITE, AND GEOLOGY

(Publications on page 47)

Helicopter Logging After the Entiat Fire

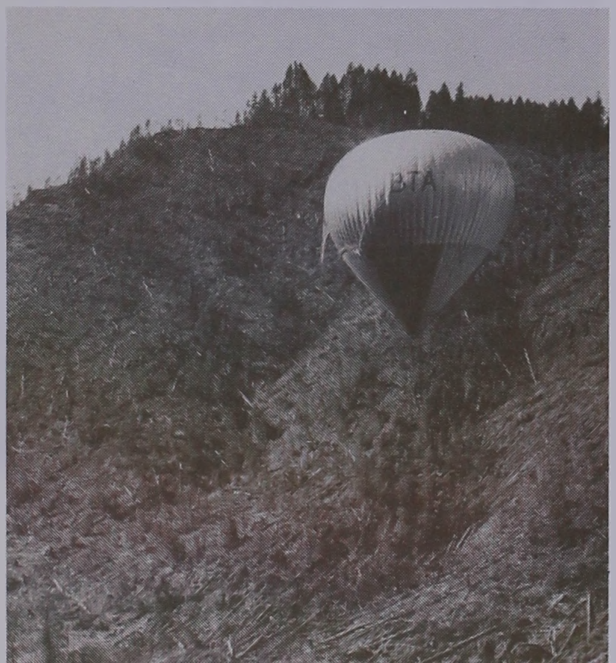
Helicopter salvage logging after fire on the Entiat Experimental Forest near Wenatchee, Washington, caused significantly less surface soil disturbance than high-lead cable skidding or tractor logging methods. Although slopes were generally steeper and soils more unstable in areas logged

with helicopter, about 88 percent of the soil surface remained undisturbed by this logging method. Comparable amounts of undisturbed soil surface were 65 percent for tractor skidding over snow, 26 percent for tractor skidding over bare ground, and 23 percent for cable skidding. Areas of severe soil disturbance were negligible after helicopter logging, whereas cable skidding and tractor over bare ground left severely disturbed areas. In the fall of 1972, soil erosion associated with logging activity was evident on only 2 percent of the helicopter-logged area. Comparable soil erosion was 41 percent on the cable skidding area, 30 percent for tractor skidding over bare ground, and 13 percent for tractor skidding over snow.

Balloon Logging Minimizes Soil Disturbance

Balloon logging caused substantially less soil disturbance than previous studies had shown for tractor, high-lead, and skyline logging methods. Deeply disturbed and compacted soil areas occupied only 4.3 percent of the total. Balloon yarding exposed less than half as much bare soil as did skyline and high-lead yarding: 6, 12, and 14 percent, respectively. Where high quality timber grows on unstable soils that might be seriously disturbed by more conventional yarding systems, logging with the helium-filled balloon appears to be one of several advanced techniques that can help keep soil on the slopes where it belongs.

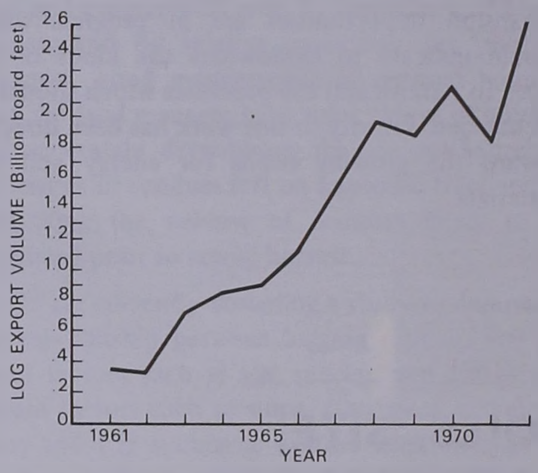
Balloon logging area at Deception Creek, Lowell District, Willamette National Forest. The sampled clearcut units are to the left of the balloon.



SUPPLY AND DEMAND

(Publications on page 48)

Washington and Oregon Log Exports Reach Record High in 1972



Log exports from Washington and Oregon, 1961-72.

Softwood log exports from Oregon and Washington totaled 2,637.1 million board feet in 1972, up 43.5 percent from the 1971 volume and up 19 percent from the previous annual high recorded in 1970. Shipments from northern California declined 24.4 percent to 77.5 million board feet. Alaska exports reached a new annual high of 65.8 million board feet in 1972, 54.5 percent more than 1971 volume. The relatively low volume from Washington, Oregon, and northern California in 1971 reflects in part labor disputes which closed ports in these three States during July-September 1971.

The average value of log exports from Washington and Oregon was $136.02 per thousand board feet, up 7.1 percent from the previous annual high in 1971.

Area Available for Timber Declines

Between 1945 and 1970, there was a net physical loss of 1 million acres of commercial forest land in Oregon and Washington to other land uses. The single greatest loss was from road construction; urban and industrial expansion was second most important. Other losses resulted from agricultural clearings, powerline clearings, and construction of reservoirs. Also since 1945, about 362,000 acres of productive forest lands, mostly in National Forests, have been set aside in reserved areas.

California Forest Survey Fieldwork Completed

This year, fieldwork for the inventory of California's 8 million acres of commercial forest land outside the National Forests was completed. A report on the timber resources of Mendocino and Sonoma Counties was also issued this year, and subsequent reports for the remainder of the State will follow as data are compiled.

The report for Mendocino and Sonoma Counties indicates a total commercial forest area of 1,560,000 acres, a total sawtimber volume of 17.8 billion board feet, and an average annual harvest of approximately 600 million board feet for the past 5 years. Future timber harvests depend on the level of management practiced. Intensified management practices such as planting, precommercial and commercial thinning, and conversion of hardwood stands to conifers are needed to maintain timber harvest at about the current level. However, since over half the commercial forest area is in farmland and miscellaneous private holdings—small parcels, short tenure, and little interest in timber production—this level of production is not likely to be sustained. The long-term future of timber production is likely to be determined primarily by the management efforts applied to public and forest industry land holdings; and consequently, total sustained production is likely to be somewhat lower than at present.

Foreign Trade in Wood Products

The role of foreign markets in U.S. wood products trade has been increasing. Today, about 10 percent of our wood products production is exported and 20 percent of what the United States consumes comes from foreign countries. Our marketing research has identified areas of the world that can be expected to have significant impact on the U.S. timber supply-demand situation in the future.

Prospects for large additions to world softwood supplies are limited to the U.S.S.R. and Canada. Future imports of softwood material should come mainly from Canada because of its proximity and because its domestic needs are small relative to volumes available. Large, untapped hardwood inventories are found in most of the world's tropical areas; southeast Asia, with its more uniform quality timber, is expected to play a dominant role in hardwood supply expansion.

Increases in wood products consumption should be substantial in western Europe, Japan, and the U.S.S.R. Exports from the United States are expected to rise despite increasing domestic requirements. Major export activity from the United States is forecast to be log shipments to Japan and pulp and paper exports to western Europe.

TIMBER MANAGEMENT

(Publications on page 48)

Huckleberry Research

A new Station research program was established during 1972 to study ecology and management of wild mountain huckleberries. Initial emphasis is on control of competing vegetation: Many huckleberry fields in Oregon and Washington are dwindling in size and productivity through invasion by low-value trees and brush. Most huckleberry fields occupy land that is marginal for timber production. In 1972, Station researchers measured berry production and species composition on representative plots, then applied cutting, burning, sheep grazing, and borax treatments. The plots will be remeasured later to determine which method is most effective for controlling competing plants. Station researchers also will study huckleberry ecology and physiology to provide a scientific base for management of this important but little known resource.

Huckleberry picking below Sawtooth Mountain, Washington.

WATER QUALITY

(Publications on page 49)

A Simple Technique for Sampling Streambed Gravel

Freezing a sample of streambed gravel and sediments with liquid CO_2 under pressure.

A simple, reliable freezing technique has proven to be a better method of sampling rocky stream gravels. A pointed copper pipe is inserted in the streambed, and liquid carbon dioxide is delivered from a storage bottle through a small delivery tube to the bottom of the pipe. The resulting heat absorption causes 1 to 2 inches of surrounding streambed to freeze and cling to the pipe in about 3 minutes. When the pipe is retrieved, a streambed sample, averaging 500 grams, comes out with it. Flowing water has no apparent effect on sample size or quality.

The new technique makes it possible to collect all materials of various size classes present at the sample location, since even the very finest sediments are locked into the frozen sample. Biologists are interested in the composition of streambed gravels, particularly in the amounts of fine sediments, since this is where salmon and trout

eggs are deposited and develop. Further modifications of the technique may facilitate collecting aquatic bottom fauna for productivity studies.

Frozen gravel and sediment sample removed from the streambed.

Hydrologic Effects of Wildfire

The timing, volume, and temperature of streamflow from the Entiat Experimental Forest were drastically altered following the severe wildfire of August 1970. Flow during the first year after the fire averaged 3.5 inches (50 percent) greater than predicted flow based on prefire conditions. Stream temperature was increased by as much as 10° F. during late summer when streams were exposed to direct insolation.

The streams were much more responsive to water input (snowmelt or rainfall) during the second year after the fire. Intense rainstorms on July 9 and August 14 produced extensive overland flow with peak discharge exceeding 50 cubic feet per second—five times greater than the maximum peak recorded during prefire calibration. These storms eroded much soil, resulting in debris torrents on all three experimental watersheds and three other watersheds in the burned area of the Entiat Valley. Two gaging stations were destroyed, road damage was extensive, and four lives were lost in the valley below.

Debris flow from McCree Creek, Entiat Experimental Forest, in March 1972. This flow completely obliterated the stream gaging station and covered the highway to a depth of 3 to 6 feet.

Water Quality After Fertilization

Water on the Entiat Experimental Forest prior to the August 1970 fire was extremely pure. For example, nitrate-N concentration was normally less than 0.005 parts per million (p.p.m.). The Federal Water Pollution Control Administration (FWPCA) has set 10 p.p.m. as the upper permissible limit for municipal water supplies.

Fire and fertilization with urea and ammonium sulfate caused increases in nitrate-N concentrations over background levels, but the highest concentration observed of 0.7 p.p.m. is well within

water quality standards set by the FWPCA and represents a very small loss of nitrogen (less than 10 lb./acre/year) from the watersheds.

Concentrations of the four major cations, Ca, Mg, K, and Na, have increased only slightly since the fire, but because of increased discharge resulting from fire, losses during spring runoff have increased threefold.

Results indicate that neither fire nor erosion control fertilization at 50 lb. of nitrogen/acre has adversely affected water quality for municipal purposes.

WILDLIFE AND TIMBER

(Publications on page 50)

Chlorogenic Acid and Deer Browsing

During our search for chemical factors influencing deer feeding preference for conifers, we discovered chlorogenic acid in Douglas-fir foliage. Previously, the compound was known to occur widely in angiosperms, but its presence in gymnosperms was reported in only two tropical genera.

Using foliage from different grafter Douglas-fir clones from a seed orchard, we found that chlorogenic acid was associated with browsing preference of black-tailed deer. Additionally, analyses of progeny of the same clones showed that concentration of chlorogenic acid in the foliage is apparently an inherited characteristic. These results suggest that parent trees can be selected in breeding Douglas-fir for resistance to deer browsing. Resistant parents can be identified by their low level of chlorogenic acid. This technique may also prove useful for screening for resistance among open-pollinated seed trees where only the female parent is known.

WOOD UTILIZATION

(Publications on page 50)

Noise Transmission Rating of Floors

A major cause of annoyance to multistory apartment dwellers is the noise produced by walkers on the floor above. We have developed a subjective method for ranking apartment floor-ceiling systems for their resistance to sound transmission due to footfalls. Results show that the current international standard of rating impact noise transmission (using a tapping machine) incorrectly ranks many floor-ceiling systems, especially those of wood joist construction.

Some of the equipment used for acoustical measurements.

With the new method, the sound of a person walking in an upstairs apartment is recorded on tape. In a playback, the level of the background and footfall noise is then adjusted by the listener so that the walking becomes just inaudible. The level of the adjustment required is used to rank the sound transmission of various floor-ceiling systems. Research is underway to develop an objective method that will correlate with this subjective method and thereby provide a needed research tool to improve acoustical privacy in wood-framed apartment buildings.

Maple Sirup from Bigleaf Maple

Collecting the sap from a full bag.

Bigleaf maple sap was collected in plastic sap bags, then boiled down to make maple sirup.

Sap flow and the quality of sirup from bigleaf maple were investigated during the winter of 1971-72. Sap flow ranged from none to 16.9 gallons per taphole and sugar content from 1.0 to 2.6 percent. Sugar content also varied seasonally, with the sweetest sap flowing in late January. The sirup was very flavorful, although not as strong in typical maple flavor as that made from eastern sugar maple. Sirup production from bigleaf maple appears feasible as a hobby. Commercial production may be possible as additional local experience is gained.

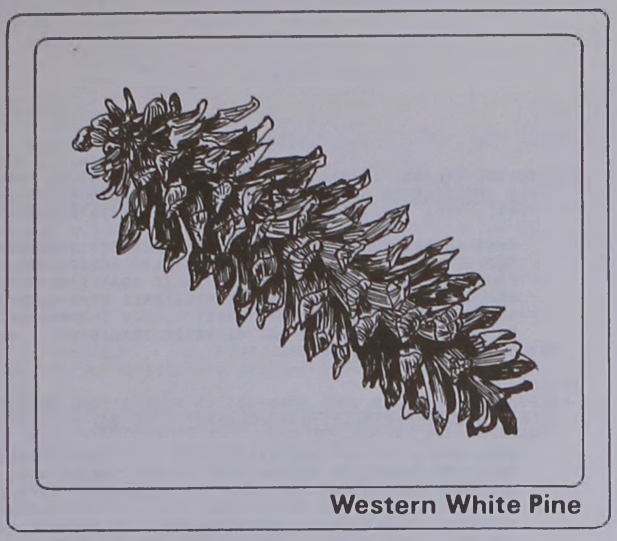
Lumber Yield and Timber Grading

Western forests produce slightly more than half the Nation's softwood timber used annually for lumber, plywood, particle board, pulp, and other forest products. To make the fullest possible use of this softwood resource, more information is needed on the physical characteristics and wood properties of trees and logs—particularly as they relate to the yield and value of various end products.

Timberland managers need timber quality and product yield information to help produce more usable wood and fiber from the available stands of timber and to appraise the value of timber to be harvested. The processors of timber also need such information for appraisal and for making manufacturing decisions that will optimize the yield and value of their raw material supplies.

Studies were conducted for several important softwood species to determine the effect of specific timber characteristics on product value and yield under various manufacturing conditions. An investigation of Alaskan Sitka spruce provided updated lumber yield information and an improved timber grading system. A lumber recovery study of commercial thinnings from young Douglas-fir timber provided yield information for three types of sawmills and data for completing a new grading system. Two studies of wetwood in white fir provided information on this particular defect that has application in stand management and lumber seasoning.

Forest Service cruisers and scientists identify log and tree characteristics that are used to develop prediction systems for product grade and volume. In these photographs, standing tree and log surface characteristics are being recorded. Log identity for each tree is maintained from the woods through bucking, scaling, and all phases of the processing operations. During processing, certified graders assist in determining product grade recovery.



Western White Pine

ANNOTATED LIST OF PUBLICATIONS BY GENERAL SUBJECTS—1972

This is a list of all publications by station staff and cooperators during the year 1972, including published talks and addresses (federal, state, or private cooperators are indicated by an asterisk). Available publications may be ordered by the five-digit number at the end of author line from Pacific Northwest Forest and Range Experiment Station, P.O. Box 3141, Portland, Oregon 97208.

BIOLOGICAL CONTROLS

DATERMAN, G. E. 09 72157
EFFECTS OF HIGH TEMPERATURE AND VAPOR PRESSURE DEFICIT ON EUROPEAN PINE SHOOT MOTH, 'RHYACIONIA BUOLIANA' (LEPIDOPTERA--OLETHREUTIDAE) EGG PRODUCTION AND SURVIVAL.
CAN. ENTOMOL. 104, P. 1387-1396, ILLUS.
FECUNDITY AND EGG SURVIVAL HAD INVERSE LINEAR RELATIONSHIPS WITH INCREASING VAPOR PRESSURE DEFICITS. SINCE HIGH VAPOR PRESSURE DEFICITS ARE COMMON IN THE WESTERN PINE REGION SUMMERS, IT IS POSSIBLE THIS FACTOR COULD LIMIT 'RHYACIONIA BUOLIANA' POPULATIONS IN SOME OF THESE AREAS.
KEYWORDS. 'RHYACIONIA BUOLIANA,' EUROPEAN PINE SHOOT MOTH, TEMPERATURE, VAPOR PRESSURE.

DATERMAN, G. E. 01 72002
LABORATORY BIOASSAY FOR SEX PHEROMONE OF THE EUROPEAN PINE SHOOT MOTH, 'RHYACIONIA BUOLIANA.'
ANN. ENTOMOL. SOC. AMER. 65(1), P. 120-123, ILLUS.
SEX PHEROMONE OF 'RHYACIONIA BUOLIANA' (SCHIFFERMULLER) WAS BIOASSAYED BY OBSERVING NUMBERS OF MALES DISPLAYING DIRECTED UPWIND ORIENTATION IN AN AIRSTREAM CONTAINING THE PHEROMONE. INCIDENCE OF RESPONSE DEPENDED ON PHEROMONE QUANTITY AND LENGTH OF TIME MALES WERE CONDITIONED AT A HIGH INTENSITY ILLUMINATION. A PHEROMONE QUANTITY EQUIVALENT TO 0.005-0.01 FEMALES WAS NECESSARY TO INDUCE DIRECTED ORIENTATION.
KEYWORDS. INSECT BEHAVIOR, INSECT BIOLOGY, BIOASSAY, EUROPEAN PINE SHOOT MOTH, 'RHYACIONIA BUOLIANA.'

HUGHES, KENNETH M. 03 72020
FINE STRUCTURE AND DEVELOPMENT OF TWO POLYHEDROSIS VIRUSES.
J. INVERTEBRATE PATHOL. 19, P. 198-207, ILLUS.
DEVELOPMENT OF TWO NUCLEAR-POLYHEDROSIS VIRUSES STARTS WITH THE FORMATION OF CAPSID TUBES WHICH BECOME FILLED WITH VIRAL NUCLEOPROTEIN. FILAMENTS BELIEVED TO BE DNA MOLECULES CAN BE DEMONSTRATED. SOME EARLIER CONCEPTS OF VIRAL STRUCTURE ARE DISCUSSED.
KEYWORDS. POLYHEDROSIS, LARVAE, VIROLOGY, 'HEMEROCAMPA PSEUDOTSUGATA,' DOUGLAS-FIR TUSSOCK MOTH.

LI, C. Y., K. C. LU, J. M. TRAPPE, AND W. B. BOLLEN* 01 72016
'PORIA WEIRII'-INHIBITING AND OTHER PHENOLIC COMPOUNDS IN ROOTS OF RED ALDER AND DOUGLAS-FIR.
MICROBIOS 5, P. 65-68.
TWO INHIBITORY COMPOUNDS WERE DETECTED IN THE 'PORIA'-RESISTANT ALDER ROOTS BUT NOT IN SUSCEPTIBLE DOUGLAS-FIR ROOTS. SUCH COMPOUNDS MAY BE IMPORTANT IN ROOT DISEASE RESISTANCE MECHANISMS.
KEYWORDS. PHENOLS, PLANT DISEASES, 'ALNUS RUBRA,' 'PORIA WEIRII,' 'PSEUDOTSUGA MENZIESII.'

MARTIGNONI, MAURO E. 03 72021
A RAPID METHOD FOR THE IDENTIFICATION OF NUCLEOPOLYHEDRON TYPES.
J. INVERTEBRATE PATHOL. 19, P. 281-283, ILLUS.
A DARK-FIELD MICROSCOPE PROCEDURE PERMITS INDIVIDUAL EXAMINATIONS OF LARGE NUMBERS OF DISEASED TUSSOCK MOTH LARVAE FOR THE RAPID IDENTIFICATION OF TWO TYPES OF VIRAL INCLUSION BODIES. THE PROCEDURE IS BASED ON THE FORMATION OF A PH GRADIENT ON A MICROSCOPE SLIDE, BY MEANS OF A BUFFER AND A SOLUTION OF SODIUM HYDROXIDE IN COLLOIDAL HYDROXYETHYL CELLULOSE.
KEYWORDS. INSECT DISEASE, 'HEMEROCAMPA PSEUDOTSUGATA,' VIROLOGY.

RYAN, R. B., AND R. D. MEDLEY. 01 72003
INTERACTION BETWEEN TWO PARASITES, 'APECHTHIS ONTARIO' AND 'ITOPLECTIS QUADRICINGULATUS.' 2. F1 PROGENY PRODUCTION IN LIGHT-STRATIFIED POPULATION CAGES.
ANN. ENTOMOL. SOC. AMER. 65(1), P. 172-177, ILLUS.
'I. QUADRICINGULATUS' MATURED FASTER, WAS MORE FECUND, AND SEARCHED AT HIGHER LIGHT INTENSITIES THAN 'A. ONTARIO.' 'A. ONTARIO' LIVED LONGER. MEASURED BY HOSTS KILLED AND PROGENY PRODUCED IN POPULATION CAGES, 'I. QUADRICINGULATUS' WAS THE BETTER SINGLE SPECIES, ALTHOUGH MIXED-SPECIES PERFORMANCE WAS AT LEAST AS GOOD. 'A. ONTARIO' ASSUMED DOMINANCE AFTER 'I. QUADRICINGULATUS' CEASED REPRODUCTION.
KEYWORDS. PARASITIC INSECTS, 'APECHTHIS ONTARIO,' 'ITOPLECTIS QUADRICINGULATUS.'

TARRANT, ROBERT F., AND JAMES M. TRAPPE 04 71198
THE ROLE OF 'ALNUS' IN IMPROVING THE FOREST ENVIRONMENT.
PLANT AND SOIL (SPEC. VOL.), P. 335-348.
EXPERIENCE WITH SEVERAL SPECIES OF 'ALNUS' INDICATES THAT SOIL FERTILITY CAN BE ENHANCED THROUGH GROWING ALDER, AND PRODUCTIVITY OF VEGETATION ASSOCIATED WITH OR SUCCEEDING ALDER CAN BE INCREASED. RED ALDER ('A. RUBRA') MAY ALSO PLAY A SIGNIFICANT ROLE IN CONTROLLING 'PORIA WEIRII' IN DOUGLAS-FIR. A DEFINITE OPPORTUNITY EXISTS TO USE ALDER IN FOREST MANAGEMENT IN A MANNER SIMILAR TO LEGUMES IN AGRICULTURE.
KEYWORDS. 'ALNUS RUBRA,' ALDER, NITROGEN-FIXATION, SOIL FERTILITY, 'PORIA WEIRII.'

TRAPPE, JAMES M. 11 71221
BIOLOGICAL CONTROL--FOREST DISEASES. 'IN' ANNU. MEET. WEST. FOREST PEST COMM. PROC. 1971.
WEST. FOR. CONSERV. ASSOC., 2 P.
CURRENT THINKING ABOUT CONTROL OF 'PORIA WEIRII' ROOT ROT.
KEYWORDS. ECOSYSTEM, ROOT ROT, FOREST MANAGEMENT.

CHEMICALS

*ANDERSON, HARRY W., RICHARD E. MILLER, AND ROBERT T. BERGLAND (EDS.) 09 72105
PROCEEDINGS FOREST FERTILIZATION WORKSHOP.
WASH. STATE DEP. NAT. RESOUR., D.N.R. REP. NO. 18, 72 P. (NO COPIES AVAILABLE)
DURING EACH OF THE PAST SEVERAL YEARS, APPROXIMATELY 90,000 ACRES OF DOUGLAS-FIR FORESTS IN WESTERN WASHINGTON AND OREGON HAVE BEEN FERTILIZED. FERTILIZATION HAS BECOME AN OPERATIONAL PRACTICE REQUIRING CLOSE COORDINATION BETWEEN THE APPLICATOR, SUPPLIER, AND OPERATIONAL FORESTER. MEANS ARE BEING DEVELOPED FOR EVALUATING AND IMPROVING BENEFIT-COST RATIOS OF FOREST FERTILIZATION.
KEYWORDS. FERTILIZATION (PLANTS), FERTILIZER APPLICATION, FERTILIZER SPREADERS, AERIAL FERTILIZERS.

*BALLARD, T. M. 01 71203
ROLE OF HUMIC CARRIER SUBSTANCES IN DDT MOVEMENT THROUGH FOREST SOIL.
SOIL SCI. SOC. AMER. PROC. 35(1), P. 146-147. (NO COPIES AVAILABLE)
THESE EXPERIMENTS INDICATE THAT HUMIC SUBSTANCES CAN ACT AS QUANTITATIVELY IMPORTANT CARRIERS OF DDT IN THE ORGANIC LAYER OF A FOREST SOIL, BUT THAT THEY MAY BE RELATIVELY INEFFECTIVE IN THE MINERAL SOIL PROFILE.
KEYWORDS. DDT, HUMUS, HUMIC ACIDS, FOREST SOILS.

BOLLEN, W. B., AND C. M. TU* 12 72202
EFFECTS OF AN ORGANOTIN ON MICROBIAL ACTIVITIES IN SOIL.
TIN AND ITS USES, VOL. 94, P. 13-15, ILLUS.
TBTO (BIS (TRI-N-BUTYLTIN) OXIDE) IS A WATER-INSOLUBLE LIQUID HAVING A HIGH AFFINITY FOR CELLULOSE. LEVELS OF TBTO TO 100 PPM IN SOIL HAD NO BIOLOGICALLY SIGNIFICANT IMPACT ON SOIL MICRO-ORGANISMS.
KEYWORDS. SOIL MICROBIOLOGY, ORGANOTIN, PEST CONTROL.

CROUCH, G. L., AND M. A. RADWAN 03 72030
ARASAN INEFFECTIVE IN ENDRIN TREATMENTS TO PROTECT DOUGLAS-FIR SEED FROM DEER MICE. (ABSTR.)
NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 3. (NO COPIES AVAILABLE)
KEYWORDS. SEED TREATMENT, ENDRIN, ARASAN.

CROUCH, G. L., AND M. A. RADWAN 07 72069
ARASAN IN ENDRIN TREATMENTS TO PROTECT DOUGLAS-FIR SEED FROM DEER MICE.
USDA FOREST SERV. RES. PAP. PNW-136, 7 P., ILLUS.
COATING WITH ENDRIN REDUCED CONSUMPTION OF DOUGLAS-FIR SEED BY DEER MICE. ARASAN DID NOT LOWER SEED CONSUMPTION, BUT ENDRIN PLUS ARASAN REDUCED FEEDING TO LEVELS COMPARABLE WITH ENDRIN ALONE. ENDRIN HAD LITTLE EFFECT ON GERMINATION, BUT ADDITION OF ARASAN CAUSED A SIGNIFICANT REDUCTION. INCREASING AMOUNTS OF ADHESIVE DECREASED THE PROTECTIVE EFFECTS OF ENDRIN TREATMENTS.
KEYWORDS. ENDRIN, THIRAM, RODENTICIDES, DOUGLAS-FIR, BIOLOGICAL ASSAY.

DATERMAN, G. E., G. D. DAVES, JR.,* AND M. JACOBSON* 06 72060
INHIBITION OF PHEROMONE PERCEPTION IN EUROPEAN PINE SHOOT MOTH BY SYNTHETIC ACETATES.
ENVIRON. ENTOMOL. 1(3), P. 382-383.
SEVERAL SYNTHETIC ACETATES WERE EFFECTIVE IN MASKING THE NATURAL SEX PHEROMONE OF THE EUROPEAN PINE SHOOT MOTH, 'RHYACIONIA BUOLIANA.' MALE ORIENTATION TO PHEROMONE SOURCES WAS SUCCESSFULLY BLOCKED IN BOTH LABORATORY AND FIELD SITUATIONS. ONE OF THE COMPOUNDS, 'CIS'-7-DODECENYL ACETATE, WAS ACTIVE AT VERY LOW CONCENTRATIONS, SUGGESTING ITS POTENTIAL VALUE AS A BEHAVIORAL CONTROL AGENT IN THE FIELD.
KEYWORDS. CHEMICAL CONTROL (INSECTS), REPRODUCTION.

GRATKOWSKI, H. 12 72200
ANNUAL VARIATION IN SUSCEPTIBILITY OF PONDEROSA PINES TO PHENOXY HERBICIDES. (ABSTR.)
WEST. SOC. WEED SCI. RES. PROG. REP. 1972, P. 20. (NO COPIES AVAILABLE)
KEYWORDS. HERBICIDES, PONDEROSA PINE.

GRATKOWSKI, H. 12 72199
FALL-SPRING EFFECTS OF PHENOXY HERBICIDES ON MANZANITA AND PONDEROSA PINE. (ABSTR.)
WEST. SOC. WEED SCI. RES. PROG. REP. 1972, P. 48. (NO COPIES AVAILABLE)
KEYWORDS. HERBICIDES, BRUSH CONTROL, MANZANITA, PONDEROSA PINE.

*JUNTUNEN, ERLAND T., AND LOGAN A. NORRIS 04 72051
FIELD APPLICATION OF HERBICIDES--AVOIDING DANGER TO FISH.
AGRIC. EXP. STN., SPEC. REP. 354, OREG. STATE UNIV., 26 P.
THIS REPORT CONSIDERS THE ROUTES OF ENTRY OF HERBICIDES TO THE AQUATIC ENVIRONMENT AND GROUPS HERBICIDES INTO FOUR GENERAL CLASSES BASED ON THEIR TOXICITY TO FISH IN LABORATORY BIOASSAYS. IT WILL HELP APPLICATORS SELECT HERBICIDES OF LOW TOXICITY WHEN THE PROBABILITY OF ENTRY OF HERBICIDE TO THE WATER IS HIGH.
KEYWORDS. HERBICIDES, FISH.

NELSON, EARL E. 01 72011
EFFECT OF UREA AND WOOD SHAVINGS ON POPULATIONS OF SOIL MICROFUNGI, ESPECIALLY 'TRICHODERMA' SPECIES.
MICROBIOS 5, P. 69-72.
UREA AND WOOD SHAVINGS MIXED WITH SOIL INDIVIDUALLY OR TOGETHER INCREASED POPULATIONS OF SOIL MICROFUNGI, WHEREAS SHAVINGS ON THE SOIL SURFACE HAD NO EFFECT. ONLY UREA INCREASED POPULATION LEVELS OF 'TRICHODERMA,' HOWEVER. ISOLATES OF 'TRICHODERMA' (97 PERCENT 'T. VIRIDE') WERE HIGHLY ANTAGONISTIC TO 'P. WEIRII.'
KEYWORDS. SOIL FUNGI, UREA, WOOD SHAVINGS.

STEWART, R. E. 12 72198
FIELD SCREENING OF FOLIAGE APPLIED HERBICIDES ON WESTERN SWORDFERN AND WESTERN BRACKEN. (ABSTR.)
WEST. SOC. WEED SCI. RES. PROG. REP. 1972, P. 20. (NO COPIES AVAILABLE)
KEYWORDS. HERBICIDES, BRUSH CONTROL.

STEWART, R. E. 12 72197
FIELD SCREENING OF GRANULAR HERBICIDES ON POLE-SIZE RED ALDER. (ABSTR.)
WEST. SOC. WEED SCI. RES. PROG. REP. 1972, P. 19. (NO COPIES AVAILABLE)
KEYWORDS. HERBICIDES, BRUSH CONTROL, RED ALDER.

STEWART, R. E. 12 72196
FIELD SCREENING OF STEM APPLIED HERBICIDES ON COAST RANGE BRUSH SPECIES. (ABSTR.)
WEST. SOC. WEED SCI. RES. PROG. REP. 1972, P. 18. (NO COPIES AVAILABLE)
KEYWORDS. HERBICIDES, BRUSH CONTROL.

STEWART, R. E. 12 72195
FOLIAGE APPLIED HERBICIDES FOR CONTROL OF OREGON COAST RANGE BRUSH SPECIES. (ABSTR.)
WEST. SOC. WEED SCI. RES. PROG. REP. 1972, P. 48. (NO COPIES AVAILABLE)
KEYWORDS. HERBICIDES, BRUSH CONTROL.

TARRANT, ROBERT F., AND JACK ALLARD* 04 72018
ARSENIC LEVELS IN URINE OF FOREST WORKERS APPLYING SILVICIDES.
ARCH. ENVIRON. HEALTH 24, P. 277-280.
FOREST TREE THINNING WORKERS ABSORB ARSENIC FROM SILVICIDES. MUCH OF THE CHEMICAL APPEARS TO BE EXCRETED FROM THE BODY IN A SHORT TIME WITH NO EVIDENCE OF A CONTINUING INCREASE IN ARSENIC LEVELS OVER A PERIOD OF MORE THAN 2 MONTHS. PERSONS USING THESE MATERIALS SHOULD MINIMIZE THEIR EXPOSURE.
KEYWORDS. SILVICIDES, ARSENIC, HEALTH.

TARRANT, R. F., D. G. MOORE, W. B. BOLLEN, AND B. W. LOPER 06 72085
DDT RESIDUES IN FOREST FLOOR AND SOIL AFTER AERIAL SPRAYING, OREGON--1965-68.
PESTIC. MONIT. J. 6(1), P. 65-72, ILLUS.
DDT WAS APPLIED AERIALLY TO AN EASTERN OREGON FOREST AT THE RATE OF 12 OUNCES PER ACRE. OVER THE FOLLOWING 3 YEARS, DDT CONTENT OF THE FOREST FLOOR DECREASED BY MORE THAN 50 PERCENT. DDT DID NOT LEACH FROM THE FOREST FLOOR INTO THE SURFACE MINERAL SOIL. OF THE 12 OUNCES OF DDT APPLIED PER ACRE, ABOUT 26 PERCENT REACHED THE GROUND SURFACE INITIALLY AND, OVER 36 MONTHS, ABOUT 6 PERCENT MORE WAS BROUGHT TO THE GROUND IN LITTERFALL.
KEYWORDS. PESTICIDE RESIDUE, DDT, ENVIRONMENT.

ECONOMICS IN FOREST MANAGEMENT

SASSAMAN, ROBERT W. 8 72107
ECONOMIC RETURNS FROM PLANTING FORAGE IN NATIONAL FORESTS.
J. FOREST. 70(8), P. 487-488, ILLUS.
ECONOMIC RETURNS FROM PLANTING FORAGE ARE SUMMARIZED FOR A VARIETY OF PLANTING COSTS AND FORAGE VALUES PRESENTLY IN EFFECT ON NATIONAL FORESTS IN THE PONDEROSA PINE-GRASS AREAS OF EASTERN WASHINGTON.
KEYWORDS. FORESTRY BUSINESS ECONOMICS, RANGE MANAGEMENT, SHELTERWOOD SYSTEM, FORAGE PLANTING.

SASSAMAN, ROBERT W., JAMES W. BARRETT, AND JUSTIN G. SMITH 12 72187
ECONOMICS OF THINNING STAGNATED PONDEROSA PINE SAPLING STANDS IN THE PINE-GRASS AREAS OF CENTRAL WASHINGTON.
USDA FOREST SERV. RES. PAP. PNW-144, 17 P., ILLUS.
PRESENT NET WORTH VALUES EARNED BY INVESTMENTS IN PRECOMMERCIAL THINNING OF STAGNATED PONDEROSA PINE SAPLING STANDS ARE REPORTED FOR THREE STOCKING LEVELS. THIRTEEN TIMBER MANAGEMENT REGIMES ARE RANKED BY THEIR RETURNS FROM TIMBER ONLY, AND 22 REGIMES ARE RANKED ACCORDING TO THEIR RETURNS FROM TIMBER AND FORAGE, WITH AND WITHOUT THE ALLOWABLE CUT EFFECT.
KEYWORDS. PONDEROSA PINE, FORESTRY BUSINESS ECONOMICS, THINNING (TREES), ALLOWABLE CUT.

SCHALLAU, CON H. 09 72176
SOME ECONOMIC GUIDES FOR INTENSIVE FOREST MANAGEMENT. 'IN' ALAN B. BERG (ED.), MANAGING YOUNG FORESTS IN THE DOUGLAS-FIR REGION.
SCH. FOR., OREG. STATE UNIV., VOL. 3, P. 97-108. (NO COPIES AVAILABLE)
A NUMBER OF ECONOMIC STUDIES OF HOW FOREST MANAGERS CAN REALIZE MAXIMUM RETURN ON THEIR YOUNG GROWTH ARE REVIEWED.
KEYWORDS. DOUGLAS-FIR, FOREST MANAGEMENT, FORESTRY BUSINESS ECONOMICS.

SCHWEITZER, DENNIS L. 7 72090
FOREST FERTILIZATION IN THE PACIFIC NORTHWEST--A CASE STUDY IN TIMBER PRODUCTION UNDER UNCERTAINTY. 'IN' UNCERTAINTY IN FORESTRY INVESTMENT DECISIONS REGARDING TIMBER GROWING.
DIV. FOR. AND WILDLIFE SCI. VIRGINIA POLYTECH. INST. AND STATE UNIV., IN COOPERATION WITH FOREST SERV., U.S. DEP. AGRIC., PUBL. FWS-1-72, P. 23-31.
INCOMPLETE PHYSICAL RESPONSE INFORMATION, DIFFICULTIES IN OBTAINING RESEARCH RESULTS IN FIELD APPLICATIONS, AND A CONCERN FOR ENVIRONMENTAL IMPACTS CHARACTERIZE INVESTMENTS IN FOREST FERTILIZATION. FOR THE PRESENT, THE PRACTICE IS ECONOMICALLY JUSTIFIED IN THE NORTHWEST BY THE ADVANTAGES OF THE ALLOWABLE CUT EFFECT.
KEYWORDS. FERTILIZATION (FOREST), FORESTRY BUSINESS ECONOMICS, FOREST POLICIES, TIMBER MANAGEMENT.

ECONOMICS IN WOOD INDUSTRY

FAHEY, THOMAS D., AND DOUGLAS L. HUNT* 06 72052
LUMBER RECOVERY FROM DOUGLAS-FIR THINNINGS AT A BANDMILL AND TWO CHIPPING CANTERS.
USDA FOREST SERV. RES. PAP. PNW-131, 9 P.
TREES CUT IN THINNING A DOUGLAS-FIR STAND WERE PROCESSED INTO LUMBER BY THREE ALTERNATIVE METHODS--A SQUARE CANT CHIPPER, A PROFILED CANT CHIPPER, AND A BANDMILL. RESULTS REPORTED INCLUDE LUMBER RECOVERY BY GRADE AND DIMENSION, RECOVERY FACTORS FOR LONG LOG SCRIBNER AND CUBIC VOLUME, AND TOTAL CHIP RECOVERY.
KEYWORDS. LUMBER, RECOVERY RATIOS, THINNING (TREES), SAWMILL EQUIPMENT.

*YERKES, VERN P., AND R. D. WOODFIN, JR. 01 72015
VENEER RECOVERY FROM BLACK HILLS PONDEROSA PINE.
USDA FOREST SERV. RES. PAP. RM-82, 23 P., ILLUS.
VENEER RECOVERED WAS SUFFICIENT IN BOTH VOLUME AND GRADES TO ALLOW PRODUCTION OF AT LEAST 3/8-INCH C-D PLYWOOD. NEARLY 45 PERCENT OF THE CUBIC-FOOT VOLUME WAS UTILIZED AS VENEER.
KEYWORDS. 'PINUS PONDEROSA,' VENEER, PLYWOOD.

FIRE

BARNEY, RICHARD J. 10 72204
AN INEXPENSIVE METEOROLOGICAL RADIATION SHIELD FOR THERMISTORS AND THERMOCOUPLES.
USDA FOREST SERV. RES. NOTE PNW-190, 7 P., ILLUS.
AN INEXPENSIVE, EASILY FABRICATED METEOROLOGICAL RADIATION SHIELD FOR THERMISTORS OR THERMOCOUPLES IS DESCRIBED. COMPARISONS MADE WITH STANDARD WOODEN 'COTTON REGION' TYPE SHELTERS SHOWED GOOD AGREEMENT.
KEYWORDS. TEMPERATURE, MEASURING EQUIPMENT, THERMISTORS, THERMOCOUPLES.

BARNEY, RICHARD J. 09 72164
A 31-DAY BATTERY-OPERATED RECORDING WEATHER STATION.
USDA FOREST SERV. RES. NOTE PNW-185, 7 P., ILLUS.
THE BATTERY-OPERATED RECORDING WEATHER STATION MEASURES AND RECORDS WET BULB TEMPERATURE, DRY BULB TEMPERATURE, WIND TRAVEL, AND RAINFALL FOR 31 DAYS. ASSEMBLY PROCEDURES AND COST OF SUPPLIES AND COMPONENTS ARE DISCUSSED.
KEYWORDS. WEATHER, MEASURING EQUIPMENT.

HELVEY, J. D. 06 72162
FIRST-YEAR EFFECTS OF WILDFIRE ON WATER YIELD AND STREAM TEMPERATURE IN NORTH-CENTRAL WASHINGTON. 'IN' WATERSHEDS IN TRANSITION.
PROC., AM. WATER RESOUR. ASSOC. AND COLO. STATE UNIV., P. 308-312, ILLUS.
INCREASES IN ANNUAL WATER YIELD AVERAGED 3.5 INCHES AFTER WILDFIRE DESTROYED THE FOREST VEGETATION ON THREE WATERSHEDS. DURING LATE SUMMER WHEN STREAMS WERE EXPOSED TO DIRECT INSOLATION, MAXIMUM DAILY STREAM TEMPERATURE INCREASED BY AS MUCH AS 10 DEG. F. NO CHANGES WERE DETECTED DURING WINTER MONTHS WHEN STREAMS WERE COVERED WITH SNOW.
KEYWORDS. FOREST FIRE EFFECTS, STREAMS, TEMPERATURE, WATER YIELD.

GENERAL

BUCKMAN, ROBERT E. 11 71219
WHERE DO WE GO FROM HERE. PROGRAMS AND OBJECTIVES, PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION.
50TH ANNU. WASH. STATE FOR. CONF. PROC., P. 19-24, ILLUS. (NO COPIES AVAILABLE)
ANTICIPATING THE NEXT FEW YEARS, THE DIRECTOR DISCUSSED--INTENSIVE CULTURE OF FAST-GROWING SPECIES ON BETTER SITES, MULTI-RESOURCE MANAGEMENT OF FOREST LANDS, PROTECTION AND MANAGEMENT OF FORESTS AND ASSOCIATED RANGE LANDS IN WILDERNESS, PARKS, REFUGES, NATURAL AREAS, ROADSIDE AND SCENIC ZONES, AND SIMILAR RESERVES, BIOLOGICAL CONTROL OF IMPORTANT FOREST PESTS, CHEMICALS IN FORESTRY, BETTER RESIDUE--AND WASTE-HANDLING PRACTICES, IMPROVED FOREST ENGINEERING METHODS, AND IMPROVED METHODS TO ALLOCATE SCARCE RESOURCES.
KEYWORDS. FOREST MANAGEMENT, FOREST PRODUCTS (RESEARCH), RANGE MANAGEMENT, FERTILIZERS, PEST CONTROL, LOGGING.

FRANKLIN, JERRY F., FREDERICK C. HALL,* C. T. DYRNESS, AND CHRIS MASER*
FEDERAL RESEARCH NATURAL AREAS IN OREGON AND WASHINGTON--A GUIDEBOOK FOR SCIENTISTS AND EDUCATORS.
USDA FOREST SERV., PAC. NORTHWEST FOREST AND RANGE EXP. STN., 498 P., ILLUS.
A GUIDE TO THE USE OF NATURAL SCIENTIFIC PRESERVES, RESEARCH NATURAL AREAS, ON FEDERAL LANDS IN OREGON AND WASHINGTON. DETAILED DESCRIPTIONS OF PHYSICAL AND BIOLOGICAL FEATURES, MAPS, AND PHOTOGRAPHS ARE PROVIDED FOR EACH OF THE 45 TRACTS PRESENTLY RESERVED. INDICES TO RESEARCH NATURAL AREAS BY VEGETATION TYPE AND PLANT AND MAMMALIAN SPECIES ARE INCLUDED. NOT AVAILABLE FROM THIS STATION. FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS, U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C. 20402--PRICE $3.50, STOCK NUMBER 0101-0225.
KEYWORDS. RESEARCH NATURAL AREAS, SCIENTIFIC RESERVES, NATURAL ECOSYSTEMS, OREGON, WASHINGTON.

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FOWLER, W. B. 12 71199
RADIOISOTOPIC MONITOR FOR RIME ACCUMULATION.
ISOTOP. AND RADIAT. TECHNOL. 9(2), P. 182, ILLUS. (NO COPIES AVAILABLE)
A SIMPLE DENSITY GAGE WAS USED AS AN OPEN-PATH DETECTOR OF ACCUMULATING RIME. ALTHOUGH SOURCE ACTIVITY WAS A LOW 2-3 MICROGRAMS OF RADIUM, IT WAS FOUND ADEQUATE FOR MEASUREMENT OVER THE RANGE OF 0-7 MM. WATER EQUIVALENT. A CIRCULAR SHIELD PREVENTS FALLING SNOW FROM AFFECTING THE READING.
KEYWORDS. MOISTURE METERS, RIME, RADIOISOTOPES, PRECIPITATION INTERCEPTION.

FRANKLIN, JERRY F., ROBERT E. JENKINS,* AND ROBERT M. ROMANCIER 06 72057
RESEARCH NATURAL AREAS--CONTRIBUTORS TO ENVIRONMENTAL QUALITY PROGRAMS.
J. ENVIRON. QUAL., P. 133-139, ILLUS.
RESEARCH PROGRAMS ON ENVIRONMENTAL QUALITY WILL REQUIRE STUDIES OF CONDITIONS IN NATURAL ENVIRONMENTS. NUMEROUS PROTECTED NATURAL ECOSYSTEMS, KNOWN AS RESEARCH NATURAL AREAS, ARE AVAILABLE FOR SUCH STUDIES. THE RESEARCH NATURAL AREA CONCEPT AND HISTORY AND SCOPE OF PRESENT PROGRAMS ARE OUTLINED. THESE TRACTS ARE PARTICULARLY VALUABLE SITES FOR BASELINE AND MONITORING PROGRAMS, FOR ECOSYSTEM STUDIES, AS IN SITU PRESERVES OF GENE POOLS, AND FOR SELECTED EDUCATIONAL PURPOSES.
KEYWORDS. RESEARCH NATURAL AREAS, RESEARCH, ECOSYSTEM, ENVIRONMENT.

GUY, WALLACE C. 10 72186
PNW ONE-MAN LAB SERVES 3 STATES, 170 RESEARCHERS.
TECH. PHOTOGR. 4(10), P. 1, 14, 15, 24, ILLUS. (NO COPIES AVAILABLE)
A DESCRIPTION IS GIVEN OF THE PHOTO LAB OF THE PNW STATION, HOW IT BEGAN, ITS EQUIPMENT, AND THE RANGE OF PHOTO SERVICES PERFORMED. ALSO THE FACT THAT THE LAB IS A ONE-MAN OPERATION, WITH SOME ANECDOTES.
KEYWORDS. PHOTOGRAPHY, AERIAL PHOTOGRAPHY.

HENDEE, JOHN C. 10 71217
BOOK REVIEW OF 'PLANNING RESEARCH FOR RESOURCE DECISIONS,' BY CARL H. STOLTENBERG, KENNETH B. WARE, ROBERT J. MARTY, ROBERT C. WRAY, AND J. D. WELLONS.
J. LEISURE RES. 3(4), P. 281-282.
PLANNING AND REPORTING RESEARCH IN NATURAL RESOURCES ARE EMPHASIZED IN A SYSTEMATIC OVERVIEW OF RESEARCH PLANNING PROCEDURES.
KEYWORDS. RESOURCE PLANNING, NATURAL RESOURCES, RESEARCH.

*NOIR, WILLIAM H. 08 72101
NATURAL AREAS.
SCIENCE 177(4047), P. 396-400.
DEFINITIONS AND HISTORY OF NATURAL AREA CONCEPT IS OUTLINED.
KEYWORDS. NATURAL AREAS, WILDERNESS AREAS, ENVIRONMENT, ECOSYSTEM.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 6 72058
ANNOTATED LIST OF PUBLICATIONS OF THE PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION FOR THE YEAR 1971.
16 P.
KEYWORDS. FORESTRY BIBLIOGRAPHY.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 05 72044
ANNUAL REPORT 1971.
56 P., ILLUS.
A SUMMARY OF THE STATION'S ACCOMPLISHMENTS FOR THE CALENDAR YEAR 1971. RESULTS IN A WIDE RANGE OF RESEARCH AREAS ARE PRESENTED IN HIGHLIGHT FORM.
KEYWORDS. FORESTRY RESEARCH.

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KEYWORDS. FORESTRY BIBLIOGRAPHY.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 12 72193
LIST OF AVAILABLE PUBLICATIONS, NO. 5, 1972.
3 P., WITH ANNOTATIONS.
KEYWORDS. FORESTRY BIBLIOGRAPHY.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 11 71220
REPORT OF ACTIVITIES, PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION.
50TH ANNU. WASH. STATE FOR. CONF. PROC., P. 85-89.
(NO COPIES AVAILABLE)
A SUMMARY OF STATION RESEARCH INCLUDED--MEASUREMENT METHODS, FOREST SURVEY, FOREST ENGINEERING, WOOD CONSTRUCTION AND USE CONCEPTS, FOREST FERTILIZATION, RECREATION, COOPERATIVE FOREST FIRE SCIENCE PROGRAM, AND WATERSHED.
KEYWORDS. RESEARCH FOREST SURVEY, TIMBER CRUISING, FOREST CUTTING SYSTEMS, WOOD UTILIZATION RESEARCH, FERTILIZATION (PLANTS), RECREATION, FOREST FIRE SCIENCE, WATERSHED MANAGEMENT.

POTTER, DALE R., KATHRYN M. SHARPE, JOHN C. HENDEE, AND ROGER N. CLARK 10 72155
QUESTIONNAIRES FOR RESEARCH--AN ANNOTATED BIBLIOGRAPHY ON DESIGN, CONSTRUCTION, AND USE.
USDA FOREST SERV. RES. PAP. PNW-140, 80 P.
QUESTIONNAIRES AS SOCIAL SCIENCE TOOLS ARE USED INCREASINGLY TO STUDY PEOPLE ASPECTS OF OUTDOOR RECREATION AND OTHER NATURAL RESOURCE FIELDS. AN ANNOTATED BIBLIOGRAPHY INCLUDING SUBJECTIVE EVALUATIONS OF EACH ARTICLE AND A KEYWORD LIST IS PRESENTED FOR 193 REFERENCES TO AID RESEARCHERS AND MANAGERS IN THE DESIGN, CONSTRUCTION, AND USE OF MAIL QUESTIONNAIRES.
KEYWORDS. BIBLIOGRAPHY, QUESTIONNAIRES, RECREATION, NATURAL RESOURCES, PUBLIC OPINION SURVEYS, RESEARCH.

GENETICS

CAMPBELL, ROBERT K. 08 71211
SOME CONCEPTS OF QUANTITATIVE GENETICS. (ABSTR.)
PROC. WEST. FOREST GENET. ASSOC. ANNU. MEET. AND SHORT COURSE, UNIV. WASH., SEATTLE, WASH., 4 P.
(NO COPIES AVAILABLE)
A BASIC VOCABULARY IS PRESENTED. THE PARTITIONING OF VARIANCES WAS EXPLAINED IN AN EXAMPLE WHICH USED FAMILY EVALUATION TESTS AS A DESIGNED EXPERIMENT. COMPONENTS OF VARIANCES WERE EXTRACTED AND PRACTICAL USE DEMONSTRATED IN A TREE BREEDING SITUATION.
KEYWORDS. GENETICS, STATISTICS.

COPES, DONALD L. 10 72172
INHERITANCE OF MEGASTROBILI COLORS IN DOUGLAS-FIR ('PSEUDOTSUGA MENZIESII').
CAN. J. BOT. 50(10), P. 2045-2048.
MEGASTROBILI COLOR WAS EXAMINED IN 395 PROGENY RESULTING FROM CROSS POLLINATIONS OF PARENTS WITH GREEN, LIGHT PINK, LIGHT RED, OR DARK RED MEGASTROBILI. CROSSES OF GREEN X GREEN PARENTS PRODUCED 49 PERCENT GREEN AND 21 PERCENT LIGHT OR DARK RED PROGENY, WHEREAS CROSSES OF LIGHT RED X DARK RED PARENTS PRODUCED 7 PERCENT GREEN AND 71 PERCENT LIGHT OR DARK RED PROGENY.
KEYWORDS. PLANT GENETICS, DOUGLAS-FIR, CONES, COLOR.

KNUTSON, DONALD M. 08 72154
CYLINDRICAL RODS--MORE EFFICIENT SPORE SAMPLERS.
PLANT DIS. REP. 56(8), P. 719-720, ILLUS.
SPORE TRAPS, MADE OF CYLINDRICAL RODS, HAVE A MUCH HIGHER TRAPPING EFFICIENCY THAN DO FLAT MICROSCOPE SLIDES.
KEYWORDS. POLLEN, SAMPLE DESIGNS (FORESTRY).

SILEN, ROY R. 08 71212
PROGRESSIVE SYSTEM OF TREE IMPROVEMENT FOR DOUGLAS-FIR. (ABSTR.)
PROC. WEST. FOREST GENET. ASSOC. ANNU. MEET. AND SHORT COURSE, UNIV. WASH., SEATTLE, WASH., 1 P.
(NO COPIES AVAILABLE)
THIS WIDELY ADOPTED DOUGLAS-FIR TREE IMPROVEMENT PROGRAM INVOLVES LARGE NUMBERS OF SELECTED PARENTS AND HALF-SIB EVALUATION TESTS OF EACH PARENT, THUS ADDING GAINS OF FAMILY SELECTION TO GAINS FROM PHENOTYPIC SELECTION.
KEYWORDS. TREE GENETICS, DOUGLAS-FIR.

SORENSEN, FRANK C. 05 72065
THE SEED ORCHARD TREE AS A POLLEN SAMPLER--A MODEL AND EXAMPLE.
USDA FOREST SERV. RES. NOTE PNW-175, 11 P., ILLUS.
A MODEL IS DEVELOPED WHICH USES THE SEED TREE AS A POLLEN SAMPLER AND ATTEMPTS TO PARTITION THE POLLEN IT RECEIVES INTO SELF POLLEN, POLLEN FROM SLIGHTLY MORE DISTANT NEIGHBORS, AND BACKGROUND POLLEN. AN EXAMPLE, USING DATA FROM SEVERAL SOURCES, IS INTRODUCED TO ILLUSTRATE THE USE OF THE MODEL.
KEYWORDS. POLLEN DISSEMINATION, SEED ORCHARDS, DOUGLAS-FIR.

INSECTS

BECKWITH, ROY C. 09 72180
KEY TO ADULT BARK BEETLES COMMONLY ASSOCIATED WITH WHITE SPRUCE STANDS IN INTERIOR ALASKA.
USDA FOREST SERV. RES. NOTE PNW-189, 6 P., ILLUS.
A DICHOTOMOUS KEY ENABLES THE DETERMINATION OF ADULT SCOLYTIDAE COMMONLY FOUND IN WHITE SPRUCE STANDS IN INTERIOR ALASKA INCLUDING THE KENAI PENINSULA. SCHEMATIC DRAWINGS ARE INCLUDED.
KEYWORDS. SCOLYTIDAE, BARK BEETLE, 'PICEA GLAUCA,' WHITE SPRUCE, ALASKA.

CAROLIN, V. M., AND W. K. COULTER 12 72220
SAMPLING POPULATIONS OF WESTERN SPRUCE BUDWORM AND PREDICTING DEFOLIATION ON DOUGLAS-FIR IN EASTERN OREGON.
USDA FOREST SERV. RES. PAP. PNW-149, 38 P., ILLUS.
SAMPLING OF TWO LIFE STAGES, EGGS AND LARVAE IN BUDS, WAS THE BASIS FOR DEVELOPING SURVEY RECOMMENDATIONS AND FOR PREDICTING DEFOLIATION ON DOUGLAS-FIR. FOR SURVEYS, OPTIMUM SIZE AND ALLOCATION OF SAMPLES WERE DETERMINED FOR VARIOUS PRECISION AND CONFIDENCE LEVELS. RANGES OF EGG MASS DENSITY AND LARVAL DENSITY WERE RELATED TO CATEGORIES OF DEFOLIATION.
KEYWORDS. WESTERN SPRUCE BUDWORM, 'CHORISTONEURA OCCIDENTALIS,' DOUGLAS-FIR, DEFOLIATION.

CAROLIN, V. M., JR., AND G. E. DATERMAN 10 72169
EUROPEAN PINE SHOOT MOTH HAZARD.
AM. FORESTS 78(10), P. 5.
STEPS BEING TAKEN TO MINIMIZE SPREAD FROM URBAN INFESTATIONS AND TO DEVELOP AN EFFICIENT DETECTION TECHNIQUE ARE DESCRIBED.
KEYWORDS. EUROPEAN PINE SHOOT MOTH, PEST CONTROL.

CAROLIN, V. M., JR., AND F. W. HONING* 02 72008
WESTERN SPRUCE BUDWORM.
U.S. DEP. AGR. FOREST PEST LEAFL. 53 (REV.), 8 P., ILLUS.
WIDESPREAD EPIDEMICS OF THIS INSECT HAVE CAUSED SERIOUS GROWTH LOSSES, TOP-KILLING, AND SOME TREE-KILLING IN POLE SIZE AND SAWTIMBER STANDS. IN RECENT YEARS IT HAS BECOME A MAJOR PEST OF SEED CROPS AND REGENERATION IN PARTS OF THE ROCKY MOUNTAINS. UPDATED INFORMATION IS GIVEN ON ITS RANGE, MEANS OF RECOGNIZING IT, AND CONTROL ASPECTS.
KEYWORDS. PEST CONTROL, DEFOLIATION, 'CHORISTONEURA OCCIDENTALIS,' WESTERN SPRUCE BUDWORM.

MASON, RICHARD R., AND TIMOTHY C. TIGNER* 12 72218
FOREST-SITE RELATIONSHIPS WITHIN AN OUTBREAK OF LODGEPOLE NEEDLE MINER IN CENTRAL OREGON.
USDA FOREST SERV. RES. PAP. PNW-146, 18 P., ILLUS.
THE DISTRIBUTION OF AN OUTBREAK POPULATION OF A LODGEPOLE NEEDLE MINER, 'COLEOTECHNITES' NEAR 'MILLERI' (BUSCK), IN CENTRAL OREGON WAS STUDIED IN RELATION TO FOREST STAND AND SITE CHARACTERISTICS. IT WAS CONCLUDED THAT DEGREE OF INFESTATION IS INFLUENCED BY A COMBINATION OF ENVIRONMENTAL AND PHYSIOLOGICAL FACTORS THAT VARY SIGNIFICANTLY UNDER DIFFERENT FOREST-SITE CONDITIONS.
KEYWORDS. 'PINUS CONTORTA' , LODGEPOLE PINE, 'COLEOTECHNITES' NEAR 'MILLERI,' LODGEPOLE NEEDLE MINER, TREE DISEASES, INSECT PESTS.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 02 72014
ECOLOGY AND IMPACTS OF FOREST INSECTS OF THE PACIFIC NORTHWEST.
2 P., ILLUS.
THE FOLDER GIVES GENERAL INFORMATION ON PERSONNEL, NATURE OF THE STUDIES, PUBLICATIONS, AND ILLUSTRATIONS OF THE RESEARCH PROJECT.
KEYWORDS. INSECT CONTROL, RESEARCH, PHYSIOLOGY.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 4 72049
PHYSIOLOGY, BEHAVIOR, AND GENETICS OF FOREST INSECTS.
2 P., ILLUS.
THE FOLDER GIVES GENERAL INFORMATION ON PERSONNEL, NATURE OF THE STUDIES, PUBLICATIONS, AND ILLUSTRATIONS OF THE RESEARCH PROJECT.
KEYWORDS. INSECT BEHAVIOR, INSECT GENETICS, INSECT PHYSIOLOGY.

SILEN, ROY R., AND DONALD L. COPES 03 72017
DOUGLAS-FIR SEED ORCHARD PROBLEMS--A PROGRESS REPORT.
J. FOREST. 70, P. 145-147.
TWO OF THE THREE MAJOR PROBLEMS WITH DOUGLAS-FIR SEED ORCHARDS--GRAFT INCOMPATIBILITY AND POLLEN CONTAMINATION--HAVE RECENTLY BEEN SOLVED BY EVASION TECHNIQUES. SEED PRODUCTION PROBLEMS ARE STILL UNSOLVED.
KEYWORDS. SEED ORCHARDS, FOREST SEED PRODUCTION, DOUGLAS-FIR, POLLEN, PLANT GRAFTING, CONES.

STELZER, MILTON J. 07 71216
WESTERN TENT CATERPILLAR.
U.S. DEP. AGRIC. FOREST PEST LEAFL. 119, 5 P., ILLUS.
IN NONTECHNICAL LANGUAGE THIS WIDESPREAD DEFOLIATOR OF HARDWOODS IS DESCRIBED AND NATURAL CONTROLS ARE DISCUSSED.
KEYWORDS. 'MALACOSMA CALIFORNICUM,' WESTERN TENT CATERPILLAR, INSECT PESTS, DEFOLIATION.

TORGERSEN, TOROLF R. 12 72205
A 'PERITHOUS' (HYMENOPTERA--ICHNEUMONIDAE) INTRODUCED FROM EUROPE.
GREAT LAKES ENTOMOL. 5(3), P. 99.
A SPECIMEN OF 'P. (HYBOMISCHOS) SEPTEMCINCTORIUS' WAS FOUND IN MICHIGAN.
KEYWORDS. INSECT IDENTIFICATION, 'PERITHOUS SEPTEMCINCTORIUS.'

*TOWNES, HENRY, AND T. R. TORGERSEN 01 72006
DIAGNOSTIC FEATURES OF THE SUBFAMILIES OF ICHNEUMONIDAE.
AMER. ENTOMOL. INST., ANN ARBOR, 3 P., ILLUS.
A CHART IS USED TO ORGANIZE IDENTIFYING FEATURES OF ICHNEUMONIDAE WASP SUBFAMILIES.
KEYWORDS. INSECT TAXONOMY, ICHNEUMONIDAE, ENTOMOLOGY.

WICKMAN, BOYD E. 08 71204
CALIFORNIA OAKWORM.
U.S. DEP. AGRIC. FOREST PEST LEAFL. 72 (REV.), 4 P., ILLUS.
THE RANGE, HOSTS, IDENTIFICATION, AND NATURAL CONTROLS ARE DISCUSSED.
KEYWORDS. 'PHRYGANIDIA CALIFORNICA,' CALIFORNIA OAKWORM, PEST CONTROL.

LOGGING

BUCKMAN, ROBERT E., AND REXFORD A. RESLER 07 72156
THE FALCON PROGRAM EXAMINES IMPROVED LOGGING METHODS.
SOUTH. LUMBERMAN 225(2789), P. 13-19, ILLUS. (NO COPIES AVAILABLE)
DESCRIBES A FOREST SERVICE RESEARCH AND DEVELOPMENT PROGRAM FOR ADVANCING THE STATE OF THE ART OF TIMBER HARVESTING ON ENVIRONMENTALLY SENSITIVE COMMERCIAL FOREST LANDS, NATIONWIDE. EMPHASIS IS ON AERIAL LOGGING, INCLUDING HELICOPTER, BALLOON, CABLE, AND OTHER SYSTEMS.
KEYWORDS. LOGGING, FOREST CUTTING SYSTEMS, BALLOONS, TIMBER MANAGEMENT.

BURKE, J. DOYLE 09 72206
ROAD AND LANDING CRITERIA FOR MOBILE-CRANE YARDING SYSTEMS.
USDA FOREST SERV. RES. NOTE PNW-186, 13 P., ILLUS.
ROAD CRITERIA FOR MOBILE-CRANE, GRAPPLE-YARDING SYSTEMS MUST COMPLEMENT THE YARDER'S MOBILITY, OPERATING SPACE REQUIREMENTS, AND THE CAPABILITY TO YARD UPHILL AND DOWNHILL. LANDINGS MUST PROVIDE SUFFICIENT ROOM FOR TRUCK AND LOADER OPERATION AND BE LOCATED OR CONSTRUCTED SO THAT LOGS WILL NOT ROLL OR SLIDE. THE ROAD AND LANDING CRITERIA DISCUSSED SHOULD BE USEFUL TO FOREST ENGINEERS INVOLVED IN PLANNING AND LAYOUT OF MOBILE-CRANE, GRAPPLE-YARDING SYSTEMS.
KEYWORDS. LOGGING, GRAPPLE YARDING, CRANES.

CARSON, WARD W. 12 71214
LATERAL EXCURSIONS OF RUNNING SKYLINES USED IN SELECTIVE CUTTINGS. 'IN' SYMPOSIUM ON FOREST OPERATIONS IN MOUNTAINOUS REGIONS.
ECON. COMM. EUROP., FOOD AGRIC. ORGAN., AND INT. LABOUR ORGAN., KRASNODAR, USSR, 21 P., ILLUS. (NO COPIES AVAILABLE)
DISCUSSES THE MEANS AND THE MATHEMATICS OF LIMITING LATERAL EXCURSIONS OF RUNNING SKYLINES BY USE OF INTERMEDIATE ANCHORS.
KEYWORDS. LOGGING, FOREST CUTTING SYSTEMS, FOREST SELECTION CUTTING.

LYSONS, HILTON H. 12 71215
CABLE LOGGING IN TOMORROW'S FOREST ENVIRONMENT.
'IN' SYMPOSIUM ON FOREST OPERATIONS IN MOUNTAINOUS REGIONS.
ECON. COMM. EUROP., FOOD AGRIC. ORGAN., AND INT. LABOUR ORGAN., KRASNODAR, USSR, 25 P., ILLUS. (NO COPIES AVAILABLE)
PRESENTS THE ENVIRONMENTAL, TECHNICAL, AND ECONOMIC CONSIDERATIONS LEADING TO DEVELOPMENT OF LONG SPAN RUNNING SKYLINE SYSTEMS.
KEYWORDS. LOGGING, FOREST CUTTING SYSTEMS, ENVIRONMENT.

MANN, CHARLES N. 12 71213
BALLOON-RUNNING SKYLINE SYSTEM. 'IN' SYMPOSIUM ON FOREST OPERATIONS IN MOUNTAINOUS REGIONS.
ECON. COMM. EUROP., FOOD AGRIC. ORGAN., AND INT. LABOUR ORGAN., KRASNODAR, USSR, 12 P., ILLUS. (NO COPIES AVAILABLE)
DISCUSSES A PROPOSED BALLOON-RUNNING SKYLINE LOGGING SYSTEM FOR USE IN MOUNTAINOUS TERRAIN WITH FAIRLY CONSTANT SLOPES AND IN SWAMPY FORESTS.
KEYWORDS. LOGGING, FOREST CUTTING SYSTEMS.

PAYNE, BRIAN R. 9 72094
ACCELERATED ROADBUILDING ON THE NORTH UMPQUA--AN ECONOMIC ANALYSIS.
USDA FOREST SERV. RES. PAP. PNW-137, 32 P., ILLUS.
ACCELERATED CONSTRUCTION OF ROADS FOR ACCESS TO OLD-GROWTH TIMBER ON A UNIT OF THE UMPQUA NATIONAL FOREST IN OREGON WAS FOUND ECONOMICALLY UNDESIRABLE, USING THE THEN-CURRENT (1966) ROADBUILDING RATE.
KEYWORDS. FOREST ROADS, FORESTRY ECONOMICS, LOGGING.

PETERS, PENN A., AND J. DOYLE BURKE 5 72104
AVERAGE YARDING DISTANCE ON IRREGULAR-SHAPED TIMBER HARVEST SETTINGS.
USDA FOREST SERV. RES. NOTE PNW-178, 13 P., ILLUS.
AVERAGE YARDING DISTANCE AND AREA ARE DETERMINED FOR IRREGULAR HARVEST SETTINGS USING THE METHOD OF MOMENTS AND A DESK-TOP PROGRAMABLE CALCULATOR WITH DIGITIZER. THE METHOD, FAST AND ACCURATE, SHOULD BE USEFUL TO THOSE INVOLVED IN TIMBER SALE LAYOUT AND APPRAISAL.
KEYWORDS. FOREST CUTTING SYSTEMS, MATHEMATICAL INSTRUMENTS, DIGITIZER.

RESLER, REXFORD A., AND ROBERT E. BUCKMAN 01 73004
THE FALCON PROGRAM--RESEARCH AND DEVELOPMENT OF ADVANCED FOREST TRANSPORT SYSTEMS.
FOREST PROD. J. 23(1), P. 13-16, ILLUS.
DESCRIBES A FOREST SERVICE RESEARCH AND DEVELOPMENT PROGRAM FOR ADVANCING THE STATE OF THE ART OF TIMBER HARVESTING ON ENVIRONMENTALLY SENSITIVE COMMERCIAL FOREST LANDS, NATIONWIDE. EMPHASIS IS ON AERIAL LOGGING, INCLUDING HELICOPTER, BALLOON, CABLE, AND OTHER SYSTEMS.
KEYWORDS. LOGGING, FOREST CUTTING SYSTEMS, BALLOONS, TIMBER MANAGEMENT.

MENSURATION

*BRUCE, DONALD 06 72062
SOME TRANSFORMATIONS OF THE BEHRE EQUATION OF TREE FORM.
FOREST SCI. 18(2), P. 164-166, ILLUS.
THE DESCRIBED EQUATIONS PERMIT FLEXIBLE TRANSFORMATIONS OF BEHRE'S HYPERBOLIC EQUATIONS FROM ONE TOP DIAMETER TO ANOTHER. THEY ALSO MAKE IT POSSIBLE TO DETERMINE COEFFICIENTS APPLICABLE TO ANY TOP DIAMETER FROM MEASUREMENTS TAKEN TO SOME OTHER MERCHANTABLE TOP.
KEYWORDS. TRANSFORMATIONS (MATHEMATICAL), TREE FORM, BEHRE HYPERBOLA.

CURTIS, ROBERT O. 01 72004
YIELD TABLES PAST AND PRESENT.
J. FOREST. 70, P. 28-32, ILLUS.
THE OBJECTIVE OF YIELD STUDIES IS PREDICTION OF STAND DEVELOPMENT AS A FUNCTION OF TIME, SITE, AND CULTURAL TREATMENT. NORMAL YIELD TABLES NO LONGER MEET OUR NEEDS. YIELD TABLES FOR MANAGED STANDS AND SOME RELATED PROBLEMS ARE BRIEFLY REVIEWED.
KEYWORDS. STAND YIELD TABLES, FOREST MANAGEMENT.

HAZARD, JOHN W., AND JOHN M. BERGER 04 72034
VOLUME TABLES VS. DENDROMETERS FOR FOREST SURVEYS.
J. FOR. 70(4), P. 216-219, ILLUS.
SUBSTANTIAL DIFFERENCES CAN EXIST IN BOTH CUBIC-FOOT AND BOARD-FOOT TREE VOLUMES ARRIVED AT BY VOLUME TABLES AND BY DIRECT MEASUREMENT ON PONDEROSA PINE WITH AN OPTICAL DENDROMETER. EVIDENCE TO JUSTIFY INVESTIGATIONS OF VOLUME TABLE BIAS IN OTHER SPECIES AND GEOGRAPHICAL LOCATIONS IS PROVIDED.
KEYWORDS. TREE VOLUME MEASUREMENT, STAND VOLUME TABLES, DENDROMETERS, FOREST SURVEYS.

HERMAN, FRANCIS R. 11 72190
IMPROVED ADAPTER FOR INCREMENT BORER RATCHET ASSEMBLY.
USDA FOREST SERV. RES. NOTE PNW-192, 4 P., ILLUS.
A STRONGER ADAPTER FOR SMALL-DIAMETER INCREMENT BORER RATCHET ASSEMBLIES CAN BE FABRICATED EASILY. A THICKER WALLED ADAPTER CAN BE MACHINED, OR A SEAMLESS CARBON-STEEL SLEEVE CAN BE SHRUNK AROUND A CUSTOM-FITTED STANDARD SQUARE-HOLED SLEEVE. 'MECHANICS' HAND CREAM IS RECOMMENCED FOR LUBRICATING DURING INCREMENT BORER USE.
KEYWORDS. TREE RINGS, TREE DIAMETER MEASUREMENT.

HERMAN, FRANCIS R., CLARK E. SMITH, 09 72168
AND JOHN E. FIRTH*
FREEZING DECAYED WOOD TO FACILITATE RING COUNTS AND WIDTH MEASUREMENTS.
USDA FOREST SERV. RES. NOTE PNW-187, 4 P., ILLUS.
ACCURATE RING COUNTS AND RADIAL GROWTH MEASUREMENTS ON DECAYED TRANSVERSE WOOD SECTIONS ARE POSSIBLE WHEN ROTTED WOOD IS FROZEN. TECHNIQUE WAS SUCCESSFULLY USED DURING STEM ANALYSIS STUDIES OF OLD-GROWTH MIXED CONIFERS IN THE OREGON-WASHINGTON CASCADE RANGE.
KEYWORDS. FOREST MEASUREMENT, TREE RINGS.

HERMAN, FRANCIS R., CLARK E. SMITH, AND JOHN E. 12 72189
FIRTH*
RING COUNT OF DECAYED WOOD MADE EASIER THROUGH FREEZING.
J. FOREST. 70(12), P. 743. (NO COPIES AVAILABLE)
ACCURATE RING COUNTS AND RADIAL GROWTH MEASUREMENTS ON DECAYED TRANSVERSE WOOD SECTIONS ARE POSSIBLE WHEN THE ROTTED WOOD IS FROZEN.
KEYWORDS. TREE RINGS, FOREST MEASUREMENT, WOOD DECAY.

JOHNSON, FLOYD A., AND GEORGE B. HARTMAN 09 72158
FALL, BUCK, AND SCALE CRUISING.
J. FOR. 70(9), P. 566-568, ILLUS.
IF THE SAMPLE TREES IN A TIMBER CRUISE ARE FELLED, BUCKED, AND SCALED, BIASES IN ESTIMATES OF TOTAL SALE VOLUME AND VALUE CAN BE AVOIDED. THE SAMPLING ERRORS OF THESE ESTIMATES CAN BE KEPT REASONABLY SMALL BY USING AN EFFICIENT SAMPLE SELECTION METHOD.
KEYWORDS. TIMBER CRUISING, STAND VOLUME ESTIMATES, FORESTRY BUSINESS ECONOMICS.

MACLEAN, COLIN D. 12 72188
IMPROVING INVENTORY VOLUME ESTIMATES BY DOUBLE SAMPLING ON AERIAL PHOTOGRAPHS.
J. FOREST 70(12), P. 748-749. (NO COPIES AVAILABLE)
A RECENT TEST OF FOREST SURVEY DATA FROM THE STATE OF WASHINGTON SHOWED PHOTO STRATIFIED DOUBLE SAMPLING TO BE ABOUT TWICE AS EFFICIENT AS SIMPLE FIELD SAMPLING AS A MEANS OF ESTIMATING TIMBER VOLUME. OPTIMUM ALLOCATION OF FIELD PLOTS WAS ONLY SLIGHTLY MORE EFFICIENT THAN PROPORTIONAL ALLOCATION.
KEYWORDS. STATISTICAL METHODS, TREE VOLUME ESTIMATES.

MACLEAN, COLIN D. 12 72216
PHOTO STRATIFICATION IMPROVES NORTHWEST TIMBER VOLUME ESTIMATES.
USDA FOREST SERV. RES. PAP. PNW-150, 10 P.
DATA FROM EXTENSIVE TIMBER INVENTORIES OF 12 COUNTIES IN WESTERN AND CENTRAL WASHINGTON WERE ANALYZED TO TEST THE RELATIVE EFFICIENCY OF DOUBLE SAMPLING FOR STRATIFICATION AS A MEANS OF ESTIMATING TOTAL VOLUME. PHOTO AND FIELD PLOTS, WHEN COMBINED IN A STRATIFIED SAMPLING DESIGN, PROVED ABOUT TWICE AS EFFICIENT AS SIMPLE FIELD SAMPLING. ALTHOUGH SOME GAINS WERE MADE BY STRATIFYING INTO ONLY TWO CLASSES--FOREST AND NONFOREST--SUBSTANTIALLY GREATER GAINS ACCRUED WHEN THE FOREST PLOTS WERE FURTHER STRATIFIED INTO TIMBER VOLUME CLASSES. OPTIMUM ALLOCATION OF FIELD PLOTS WAS ONLY SLIGHTLY MORE EFFICIENT THAN PROPORTIONAL ALLOCATION.
KEYWORDS. DOUBLE SAMPLING, PHOTO SAMPLING, TIMBER VOLUME ESTIMATES.

MANN, CHARLES N., AND HILTON H. LYSONS 9 72100
A METHOD OF ESTIMATING LOG WEIGHTS.
USDA FOREST SERV. RES. PAP. PNW-138, 75 P., ILLUS.
PRESENTS A PRACTICAL METHOD ESTIMATING THE WEIGHT OF LOGS BEFORE THEY ARE YARDED. THE METHOD IS BASED ON OBTAINING AN INITIAL SAMPLE FOR A CUBIC DENSITY INDEX AND THEN APPLYING THE INDEX TO LOG DIMENSIONS FOR WEIGHT ESTIMATES. THE USE OF THIS METHOD SHOULD FACILITATE THE APPLICATION OF AERIAL LOGGING SYSTEMS.
KEYWORDS. LOGS, WEIGHTS, LOGGING.

POPE, ROBERT B., BIJAN PAYANDEH,* AND 12 72210
DAVID P. PAINE*
PHOTO PLOT BIAS.
USDA FOREST SERV. RES. PAP. PNW-145, 8 P.
NONUNIFORM SPACING OF AERIAL PHOTOS CAN SERIOUSLY BIAS FOREST INVENTORY RESULTS IF PLOTS ARE SYSTEMATICALLY LOCATED ON PHOTOS. A MAP-TRANSFER PROCESS AVOIDS THIS.
KEYWORDS. AERIAL PHOTOGRAPHY, FOREST SURVEYS, PHOTOGRAPHY.

PATHOLOGY

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 05 72055
FOREST DISEASES OF THE PACIFIC NORTHWEST.
2 P., ILLUS.
THE FOLDER GIVES GENERAL INFORMATION ON PERSONNEL, NATURE OF THE STUDIES, PUBLICATIONS, AND ILLUSTRATIONS OF THE RESEARCH PROJECT.
KEYWORDS. TREE DISEASES, RESEARCH, DWARF MISTLETOE.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 03 72038
ROOT DISEASES AND SOIL MICROBIOLOGY.
2 P., ILLUS.
THE FOLDER GIVES GENERAL INFORMATION ON PERSONNEL, NATURE OF THE STUDIES, PUBLICATIONS, AND ILLUSTRATIONS OF THE RESEARCH PROJECT.
KEYWORDS. PLANT DISEASES, ROOTS, MICRO-ORGANISMS, FUNGUS, FUNGUS DISEASES (PLANTS).

ROTH, L. F., H. H. BYNUM, AND E. E. NELSON 8 72099
PHYTOPHTHORA ROOT ROT OF PORT-ORFORD-CEDAR.
U.S. DEP. AGR. FOREST PEST LEAFL. 131, 7 P., ILLUS.
PORT-ORFORD-CEDAR SHOWS NO RESISTANCE TO THIS LETHAL PATHOGEN, WHOSE SPORES SPREAD IN FLOWING WATER OR WITH MOVEMENT OF SOIL. UNINFECTED STANDS MAY BE PROTECTED BY RESTRICTING ACCESS BY MEN, ANIMALS, AND MACHINES.
KEYWORDS. 'CHAMAECYPARIS LAWSONIANA,' PORT-ORFORD-CEDAR, SOIL FUNGI, ROOTS, TREE DISEASES.

SHEA, KEITH R., AND JAMES L. STEWART* 10 72178
HEMLOCK DWARF MISTLETOE.
U.S. DEP. AGRIC. FOREST PEST LEAFL. 135, 6 P. ILLUS.
THE DISTRIBUTION, HOSTS, LIFE CYCLE, SYMPTOMS, SPREAD, AND INTENSIFICATION, DAMAGE, AND CONTROL OF THIS PARASITE OF HEMLOCK IN THE WEST IS SUMMARIZED.
KEYWORDS. HEMLOCK DWARF MISTLETOE, 'ARCEUTHOBIUM TSUGENSE,' HEMLOCK, PARASITIC PLANTS.

*SMITH, ALEXANDER H., AND JAMES M. TRAPPE 10 72175
THE HIGHER FUNGI OF OREGON'S CASCADE HEAD EXPERIMENTAL FOREST AND VICINITY--I. THE GENUS 'PHAEOCOLLYBIA' (AGARICALES), AND NOTES AND DESCRIPTIONS OF OTHER SPECIES IN THE AGARICALES.
MYCOLOGIA 64(5), P. 1138-1153, ILLUS.
STUDIES OF THE FUNGI OF THE NORTHWESTERN OREGON COAST HAVE REVEALED A GREAT DIVERSITY OF SPECIES, MANY HERETOFORE UNKNOWN TO BOTANISTS AND FORESTERS. THE EIGHT NEW SPECIES DESCRIBED IN THIS INITIAL REPORT ARE EITHER DECOMPOSERS OF SOIL ORGANIC MATTER OR MYCORRHIZAL ASSOCIATES OF CONIFERS, GROUPS OF GREAT IMPORTANCE TO THE FOREST ECOSYSTEM.
KEYWORDS. FUNGI, AGARICALES, NOMENCLATURE, OREGON COAST.

TRAPPE, JAMES M. 12 72215
PARASITISM OF HELVELLA LACUNOSA BY CLITOCYBE SCLEROTOIDEA.
MYCOLOGIA 64, P. 1337-1340, ILLUS.
PARASITISM BY MYCELIUM OF THE GILL-MUSHROOM ('CLITOCYBE') DEFORMS BUT DOES NOT KILL THE FALSE MOREL ('HELVELLA') FRUITING BODY. THE PARASITE EVIDENTLY PRODUCES GROWTH REGULATORS TO ACHIEVE THIS EFFECT.
KEYWORDS. PARASITISM, MYCOLOGY.

TRAPPE, JAMES M., AND JAMES W. GERDEMANN* 12 72223
'ENDOGONE FLAMMICORONA' SP. NOV., A DISTINCTIVE SEGREGATE FROM 'ENDOGONE LACTIFLUA.'
TRANS. BR. MYCOL. SOC. 59(3), P. 403-407, ILLUS.
KEYWORDS. 'ENDOGONE FLAMMICORONA' SP. NOV., TAXONOMY, MYCORRHIZAE.

TRAPPE, JAMES M., AND JAMES W. KIMBROUGH* 06 72050
'ELAPHOMYCES VIRIDISEPTUM,' A NEW SPECIES FROM FLORIDA.
MYCOLOGIA 64(3), P. 646-649, ILLUS.
A NEW SUBTERRANEAN, MYCORRHIZA-FORMING 'FALSE TRUFFLE' FUNGUS FROM FLORIDA IS DESCRIBED.
KEYWORDS. 'ELAPHOMYCES VIRIDISEPTUM', ASCOMYCETES, NOMENCLATURE.

WICKMAN, BOYD E., AND ROBERT F. SCHARPF* 9 72097
DECAY IN WHITE FIR TOP-KILLED BY DOUGLAS-FIR TUSSOCK MOTH.
USDA FOREST SERV. RES. PAP. PNW-133, 9 P., ILLUS.
NO DECAY RESULTING IN CULL OCCURRED IN TREES TOP-KILLED BY DOUGLAS-FIR TUSSOCK MOTH, AND ONLY ONE TREE TOP-KILLED BY FIR ENGRAVER BEETLES CONTAINED DECAY WHICH RESULTED IN CULL. HOWEVER, A DISCOLORATION OF THE HEARTWOOD KNOWN AS WETWOOD WAS COMMON IN TOP-DAMAGED TREES.
KEYWORDS. WOOD DECAY, 'HEMEROCAMPA PSEUDOTSUGATA,' DOUGLAS-FIR TUSSOCK MOTH.

WILCOX, W. WAYNE, AND NANCY D. OLDHAM
BACTERIUM ASSOCIATED WITH WETWOOD IN WHITE FIR.
PHYTOPATHOLOGY 62, P. 384-385.
COOP-AID STUDY OF PNW-UNIVERSITY OF CALIFORNIA. INDICATES THE OCCURRENCE AND CHARACTERISTICS OF BACTERIA FOUND IN WETWOOD OF WHITE FIR. AVAILABLE ONLY FROM UNIVERSITY OF CALIFORNIA, FOREST PRODUCTS LABORATORY, RICHMOND, CALIFORNIA 94804.
KEYWORDS. WETWOOD, BACTERIUM, 'ABIES CONCOLOR,' WHITE FIR, TREE DISEASES.

WILCOX, W. WAYNE, AND CLEMENS G. R. SCHLINK 12 71202
ABSORPTIVITY AND PIT STRUCTURE AS RELATED TO WETWOOD IN WHITE FIR.
WOOD AND FIBER 2(4), P. 373-379, ILLUS. (NO COPIES AVAILABLE)
NO ALTERATIONS IN WOOD STRUCTURE, SUCH AS DECOMPOSITION OF RAY PARENCHYMA CELL WALLS OR BORDERED PIT TORI, WERE OBSERVED IN ANY OF THE SAMPLES. APPARENTLY THE BACTERIUM PRESENT IN WHITE FIR WETWOOD DOES NOT ALTER WOOD STRUCTURE IN THE SAME MANNER AS OTHER BACTERIA KNOWN TO BE WOOD ATTACKERS.
KEYWORDS. 'ABIES CONCOLOR,' WHITE FIR, WETWOOD, WOOD PERMEABILITY, WOOD STRUCTURE.

YOUNG, J. L., I. HO, AND J. M. TRAPPE 11 72181
ENDOMYCORRHIZAL INVASION AND EFFECT ON FREE AMINO CONTENT OF CORN ROOTS.
AGRON. ABSTR., 1 P. (NO COPIES AVAILABLE)
KEYWORDS. ENDOMYCORRHIZAE, AMINO ACIDS, CORN.

ZAK, B. 05 72040
FLOTATION OF EXCISED ROOT AND FUNGAL CULTURES ON LIQUID MEDIA.
CAN. J. MICROBIOL. 18, P. 536-538, ILLUS.
A METHOD OF FLOATING EXCISED ROOTS AND FUNGAL CULTURES ON LIQUID MEDIA USING DISCS OF NYLON AND DACRON NETTING IS DESCRIBED.
KEYWORDS. CULTURE MEDIA, FLOTATION, ROOTS FUNGI.

PHYSIOLOGY

MITCHELL, R. G. 03 72026
NEEDLE POPULATIONS ON YOUNG DOUGLAS-FIR IN WESTERN OREGON AND WASHINGTON. (ABSTR.)
NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 10. (NO COPIES AVAILABLE)
KEYWORDS. FOREST MEASUREMENT, DOUGLAS-FIR.

OWSTON, PEYTON W. 03 72025
TRANSPIRATION OF DOUGLAS-FIR SEEDLINGS GROWN UNDER DIFFERENT MOISTURE REGIMES. (ABSTR.)
NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 10. (NO COPIES AVAILABLE)
KEYWORDS. SEEDLINGS, SOIL MOISTURE, DOUGLAS-FIR.

OWSTON, PEYTON W., JAMES L. SMITH,* AND HOWARD G. HALVERSON*
SEASONAL WATER MOVEMENT IN TREE STEMS.
FOREST SCI. 18(4), P. 266-272. (AVAILABLE ONLY FROM PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION, P. O. BOX 245, BERKELEY, CALIFORNIA 94701)
WITH RADIOISOTOPE METHODOLOGY, WATER MOVEMENT IN A 60-YEAR-OLD LODGEPOLE PINE AND RED FIR FOREST WAS ESTIMATED.
KEYWORDS. LODGEPOLE PINE, 'PINUS CONTORTA,' RED FIR, 'ABIES MAGNIFICA,' RADIOISOTOPES, PLANT TRANSPIRATION.

RADWAN, M. A. 07 72095
DIFFERENCES IN PHENOLS AND MONOTERPENE HYDROCARBONS AMONG DOUGLAS-FIR GENOTYPES. (ABSTR.)
PLANT PHYSIOL., 49 (SUPPL.), P. 6. (NO COPIES AVAILABLE)
KEYWORDS. DOUGLAS-FIR, PHENOLS, TERPENES, BROWSE.

RADWAN, M. A. 01 72033
OCCURRENCE AND GENOTYPIC DIFFERENCES OF CHLOROGENIC ACID IN DOUGLAS-FIR FOLIAGE.
USDA FOREST SERV. RES. NOTE PNW-173, 6 P.
CHLOROGENIC ACID WAS IDENTIFIED IN THE FOLIAGE OF DOUGLAS-FIR DURING THE DORMANT SEASON. CONCENTRATIONS VARIED AMONG GENOTYPES AND RANGED BETWEEN 75 AND 390 P.P.M. IN THE FRESH TISSUE.
KEYWORDS. PLANT PHYSIOLOGY, DOUGLAS-FIR CLONES, CHROMATOGRAPHY, CAFFEOYLQUINIC ACID.

ROSS, WILLIAM D., AND ROBERT L. KRAHMER 04 71201
SOME SOURCES OF VARIATION IN STRUCTURAL CHARACTERISTICS OF DOUGLAS-FIR BARK.
WOOD AND FIBER 3(1), P. 35-46, ILLUS. (NO COPIES AVAILABLE)
DEVELOPMENT OF A CLASSIFICATION SYSTEM BASED ON THE EXTERNAL APPEARANCE OF THE BARK SURFACE THAT WOULD CORRELATE WITH ANATOMICAL CHARACTERISTICS OF THE BARK WAS NOT POSSIBLE. MODIFICATION OF BARK BY FUNGI WAS OBSERVED TO OCCUR IN SEVERAL SPECIFIC WAYS.
KEYWORDS. 'PSEUDOTSUGA MENZIESII,' DOUGLAS-FIR, BARK, FUNGI.

SEIDEL, KENNETH W. 03 72070
DROUGHT RESISTANCE AND INTERNAL WATER BALANCE OF OAK SEEDLINGS.
FOREST SCI. 18(1), P. 34-40, ILLUS. (NO COPIES AVAILABLE)
POST OAK WAS THE MOST DROUGHT RESISTANT OF FOUR SPECIES, PRIMARILY BECAUSE OF GREATER DROUGHT TOLERANCE OF LEAF AND ROOT CELLS. BLACK OAK AND WHITE OAK DIFFERED LITTLE IN TOLERANCE AND AVOIDANCE. DROUGHT AVOIDANCE OF RED OAK LEAVES WAS SIGNIFICANTLY LOWER THAN THAT OF THE OTHER SPECIES, AND DROUGHT TOLERANCE OF RED OAK ROOTS WAS THE LOWEST OF THE FOUR SPECIES.
KEYWORDS. 'QUERCUS,' OAK, DROUGHT RESISTANT PLANTS, TRANSPIRATION.

*VAN CLEVE, KEITH, AND LESLIE A. VIERECK 09 72102
DISTRIBUTION OF SELECTED CHEMICAL ELEMENTS IN EVEN-AGED ALDER ('ALNUS') ECOSYSTEMS NEAR FAIRBANKS, ALASKA.
ARCTIC AND ALPINE RES. 4(3), P. 239-255, ILLUS. (NO COPIES AVAILABLE)
THIS STUDY REPORTS THE DISTRIBUTION OF SELECTED NUTRIENT ELEMENTS ON 5-, 15- AND 20-YEAR-OLD ALDER ECOSYSTEMS DEVELOPING ON THE TANANA RIVER FLOODPLAIN IN CENTRAL ALASKA. DISTRIBUTION OF ELEMENTS IS SHOWN FOR FOLIAGE, BRANCHES, BOLES, LITTER, ROOTS, AND SOIL BY PERCENTAGE AND ON A KILOGRAM PER HECTARE BASIS.
KEYWORDS. ALDER, 'ALNUS,' PLANT NUTRITION, POTASSIUM, ECOSYSTEM.

PLANT ECOLOGY

FRANKLIN, JERRY F. 03 72024
WHY A CONIFEROUS FOREST BIOME. (ABSTR.)
NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 5. (NO COPIES AVAILABLE)
KEYWORDS. ECOLOGY, RESEARCH.

FRANKLIN, JERRY F. 8 72081
WHY A CONIFEROUS FOREST BIOME. 'IN' JERRY F. FRANKLIN, L. J. DEMPSTER, AND RICHARD H. WARING (EDS.), PROCEEDINGS--RESEARCH ON CONIFEROUS FOREST ECOSYSTEMS--A SYMPOSIUM.
USDA FOREST SERV. PAC. NORTHWEST FOREST AND RANGE EXP. STN., P. 3-5.
THIS INTRODUCTION TO THE SYMPOSIUM OUTLINES SOME OF THE REASONS LARGE INTEGRATED ECOLOGICAL RESEARCH PROGRAMS HAVE BEEN DEEMED NECESSARY DESPITE PROBLEMS INHERENT IN SUCH 'LARGE SCIENCE' PROGRAMS.
KEYWORDS. RESEARCH, ENVIRONMENT, ECOSYSTEM, FOREST MANAGEMENT.

FRANKLIN, JERRY F., L. J. DEMPSTER,* AND
RICHARD H. WARING* (EDS.)
1972. PROCEEDINGS--RESEARCH ON CONIFEROUS FOREST ECOSYSTEMS--A SYMPOSIUM.
USDA FOREST SERV., PAC. NORTHWEST FOREST AND RANGE EXP. STN., 322 P., ILLUS.
A SERIES OF 31 PAPERS SUMMARIZING MAJOR SEGMENTS OF THE CONIFEROUS FOREST BIOME PROGRAM IN ECOSYSTEM ANALYSIS. SUBJECTS INCLUDE PLANNING AND MODELING CONCEPTS, NEW TECHNIQUES AND DATA, AND REVIEWS OF EXISTING INFORMATION. NOT AVAILABLE FROM THIS STATION. FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS, 20402--PRICE $2.50, STOCK NUMBER 0101-C233 OR CAT. A13.66/2:EC7
U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C.
KEYWORDS. ECOSYSTEM, RESEARCH, PHOTOSYNTHESIS, PRODUCTIVITY, HYDROLOGY, ENERGY, LAKES, STREAMS, DOUGLAS-FIR, LODGEPOLE PINE.

FREDRIKSEN, R. L. 8 72082
NUTRIENT BUDGET OF A DOUGLAS-FIR FOREST ON AN EXPERIMENTAL WATERSHED IN WESTERN OREGON. 'IN' JERRY F. FRANKLIN, L. J. DEMPSTER, AND RICHARD H. WARING (EDS.), PROCEEDINGS--RESEARCH ON CONIFEROUS FOREST ECOSYSTEMS--A SYMPOSIUM.
USDA FOREST SERV. PAC. NORTHWEST FOREST AND RANGE EXP. STN., P. 115-131.
THE STUDY INVOLVED NITROGEN, PHOSPHORUS, THE CATIONS, AND SILICA--AMOUNTS ADDED BY PRECIPITATION AND RETAINED BY THE FOREST AND HYPOTHESES ABOUT PROCESSES REGULATING THEIR LOSS FROM THE FOREST.
KEYWORDS. WATERSHEDS, 'PSEUDOTSUGA MENZIESII,' DOUGLAS-FIR, PRECIPITATION, NITROGEN, NUTRIENTS.

FREDRIKSEN, R. L. 03 72029
NUTRIENT BUDGETS OF DOUGLAS-FIR FORESTS ON TWO SMALL EXPERIMENTAL WATERSHEDS IN WESTERN OREGON. (ABSTR.)
NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 5. (NO COPIES AVAILABLE)
KEYWORDS. RUNOFF MEASUREMENT, WATERSHEDS, SOILS.

MINORE, DON 03 72028
A CLASSIFICATION OF FOREST ENVIRONMENTS IN THE SOUTH UMPQUA BASIN. (ABSTR.)
NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 9. (NO COPIES AVAILABLE)
KEYWORDS. FOREST TYPES, CLASSIFICATION, SILVICULTURE.

MINORE, DON 04 72022
A CLASSIFICATION OF FOREST ENVIRONMENTS IN THE SOUTH UMPQUA BASIN.
USDA FOREST SERV. RES. PAP. PNW-129, 28 P., ILLUS.
A CLASSIFICATION OF FOREST ENVIRONMENTS BY ELEVATION, TEMPERATURE, MOISTURE, POTENTIAL SOLAR RADIATION, AND SOIL TYPE IS DESCRIBED. IT FACILITATES COMPARISONS OF FORESTED AREAS--COMPARISONS THAT EVENTUALLY SHOULD MAKE IT POSSIBLE TO PRESCRIBE OPTIMAL MANAGEMENT PRACTICES FOR EVERY FOREST ENVIRONMENT IN THE SOUTH UMPQUA BASIN.
KEYWORDS. CLASSIFICATION, ENVIRONMENT, INDICATOR PLANTS, TEMPERATURE, MOISTURE, SOLAR RADIATION, SOIL SERIES.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 9 72108
RECENT REPORTS OF INTEREST TO PLANT ECOLOGISTS.
14 P.
A BIBLIOGRAPHY OF PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION PUBLICATIONS ON PLANT ECOLOGY.
KEYWORDS. PLANT ECOLOGY BIBLIOGRAPHY.

TARRANT, R. F. 09 72173
THE ROLE OF ALDER IN IMPROVING SOIL FERTILITY AND GROWTH OF ASSOCIATED TREES. 'IN' ALAN B. BERG (ED.), MANAGING YOUNG FORESTS IN THE DOUGLAS-FIR REGION.
SCH. FOR., OREG. STATE UNIV., VOL. 3, P. 17-33, ILLUS.
(NO COPIES AVAILABLE)
WORLDWIDE EXPERIENCE WITH A NUMBER OF 'ALNUS' SPECIES INDICATES THAT ALDER CONTRIBUTES SIGNIFICANTLY TO THE SUPPLY OF NITROGEN IN THE FOREST ECOSYSTEM. THIS CONTRIBUTION HAS A SIGNIFICANT, BENEFICIAL IMPACT ON SOIL FERTILITY AND, IN TURN, ON VEGETATION ASSOCIATED WITH OR SUCCEEDING ALDER.
KEYWORDS. ALDER, 'ALNUS,' SOIL FERTILITY, NITROGEN-FIXATION.

VIERECK, L. A. 12 71210
THE IBP-PT PROGRAM IN THE TAIGA OF ALASKA. 'IN' SYSTEMS ANALYSIS IN NORTHERN CONIFEROUS FORESTS--IBP WORKSHOP.
SWED. NAT. SCI. RES. COUNC., BULL. ECOL. RES. COMM. 14, P. 58-61. (NO COPIES AVAILABLE)
GENERAL DETAILS OF SOME IBP RELATED RESEARCH ARE GIVEN INCLUCING BIOENVIRONMENTAL GRADIENTS, HOT PIPELINE STUDY, POKER-CARIBOU CREEK WATERSHED, NUTRIENT CYCLES IN INTERIOR ALASKA FOREST TYPES, WHITE SPRUCE REGENERATION, AND FIRE EFFECTS IN THE TAIGA.
KEYWORDS. ECOLOGY, ALASKA, TAIGA, VEGETATION.

VIERECK, LESLIE A., AND ELBERT L. LITTLE, JR.*
ALASKA TREES AND SHRUBS.
U.S. DEP. AGRIC. HANDBOOK NO. 410, 265 P., ILLUS.
HARD COVER HANDBOOK LISTS 128 SPECIES OF NATIVE WOODY PLANTS WITH DESCRIPTIONS, ILLUSTRATIONS, DISTRIBUTION, AND USES. NOT AVAILABLE FROM THIS STATION. FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS, U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C. 20402--PRICE $3.25.
KEYWORDS. TREES, SHRUBS, TREE IDENTIFICATION, WOODY PLANTS, ALASKA.

RANGE ECOSYSTEMS

DEALY, J. EDWARD 04 72046
IDAHO FESCUE PREFERENCE.
WEST. LIVESTOCK J. 50(26), P. 40-44, ILLUS.
IN CENTRAL OREGON, COWS NORMALLY AVOID GRAZING IDAHO FESCUE GROWING UNDER PONDEROSA PINE. WHEN THE MIXTURE OF ACCUMULATED DEAD LITTER AND PINE NEEDLES WAS REMOVED FROM THE FESCUE CLUMPS, THE GREEN GRASS WAS EATEN READILY. TECHNIQUES OF LITTER REMOVAL ARE DISCUSSED.
KEYWORDS. FESCUE, RANGE MANAGEMENT, LIVESTOCK.

GARRISON, GEORGE A.
CARBOHYDRATE RESERVES AND RESPONSE TO USE. 'IN' CYRUS M. MCKELL, JAMES P. BLAISDELL, AND JOE R. GOODIN (EDS.), WILDLAND SHRUBS--THEIR BIOLOGY AND UTILIZATION.
USDA FOREST SERV. GEN. TECH. REP. INT-1, P. 271-278, ILLUS.
A REVIEW IS PRESENTED OF RANGELAND SHRUB RESEARCH ON PHYSIOLOGY AND SEASONAL TRENDS OF MOBILIZABLE CARBOHYDRATES IN VARIOUS PLANT PARTS. RESPONSES OF SEVERAL NORTH AMERICAN SHRUBS TO SIMULATED UTILIZATION ARE ALSO SUMMARIZED. EMPHASIS IS ON BROWSE SPECIES SUCH AS 'PURSHIA TRIDENTATA.' NOT AVAILABLE FROM THIS STATION. REQUEST FROM INTERMOUNTAIN FOREST AND RANGE EXP. STN., OGDEN, UTAH 84401.
KEYWORDS. WOODY PLANTS, CARBOHYDRATES, PLANT ECOLOGY.

TIEDEMANN, A. R., AND H. W. BERNDT 01 72010
VEGETATION AND SOILS OF A 30-YEAR DEER AND ELK EXCLOSURE IN CENTRAL WASHINGTON.
NORTHWEST SCI. 46(1), P. 59-66, ILLUS.
VEGETATION AND SOILS OF A DEER AND ELK EXCLOSURE MAINTAINED SINCE 1939 WERE COMPARED WITH AN ADJACENT AREA OF CONTINUOUS GAME USE IN 1970. DESPITE THE SIMILARITY OF SOIL CHARACTERISTICS BETWEEN THE EXCLOSURE AND OUTSIDE, IT APPEARS THAT SNOWBRUSH CEANOTHUS HAS HAD AN AMELIORATING EFFECT ON THE EXCLOSURE BECAUSE OF THE GREATER BIOMASS AND LITTER.
KEYWORDS. RANGE MANAGEMENT, SOILS, VEGETATION, SNOWBUSH CEANOTHUS.

RECREATION

*BULTENA, GORDON L., AND JOHN C. HENDEE 6 72053
FORESTERS' VIEWS OF INTEREST GROUP POSITIONS ON FOREST POLICY.
J. FOR. 70(6), P. 337-342, ILLUS.
FORESTERS ON FIVE NATIONAL FORESTS IN THE PACIFIC NORTHWEST, WHEN IDENTIFYING SPECIAL INTEREST GROUP POSITIONS ON TIMBER CUTTING, ALIGNED THEMSELVES WITH COMMERCIAL VS. RECREATIONAL-ESTHETIC INTERESTS, VIEWING THE LATTER AS HAVING UNJUSTIFIED EXPECTATIONS. ON THE ISSUE OF OPENING TRAILS TO MOTOR BIKES, FORESTERS SAW A SPLIT AMONG RECREATIONAL INTERESTS.
KEYWORDS. FOREST POLICIES, FORESTERS, ENVIRONMENT, RECREATION.

CLARK, ROGER N., ROBERT L. BURGESS,* AND 05 72047
JOHN C. HENDEE
THE DEVELOPMENT OF ANTI-LITTER BEHAVIOR IN A FOREST CAMPGROUND.
J. APPL. BEHAV. ANAL. 5(1), P. 1-5, ILLUS.
CHILDREN WERE OFFERED A REWARD FOR PICKING UP AND PROPERLY DISPOSING OF LITTER, RESULTING IN A SHARP DECLINE IN FOUR TYPES OF LITTER PLANTED IN THE CAMPGROUND.
KEYWORDS. LITTER (PUBLIC PLACES), FOREST RECREATIONAL USE, CAMPING, NATIONAL FORESTS.

CLARK, ROGER N., JOHN C. HENDEE, AND ROBERT L. BURGESS* 12 72211
THE EXPERIMENTAL CONTROL OF LITTERING.
J. ENVIRON. EDUC. 4(2), P. 22-28.
TRACITIONAL APPROACHES TO LITTER CONTROL, INCLUDING DIRECT APPEALS, ANTILITTER MESSAGES, ADDITIONAL TRASH CANS, AND LITTERBAGS, WERE MUCH LESS EFFECTIVE THAN SMALL INCENTIVES IN EFFECTS ON ANTILITTER BEHAVIOR.
KEYWORDS. LITTER (PUBLIC PLACES), ENVIRONMENT, FOREST RECREATIONAL USE.

CLARK, ROGER N., JOHN C. HENDEE, AND RANDALL F. WASHBURNE 8 72103
LITTERBAGS--AN EVALUATION OF THEIR USE.
USDA FOREST SERV. RES. NOTE PNW-184, 5 P.
A STUDY CONDUCTED IN MOUNT RAINIER NATIONAL PARK INDICATES THAT ONLY A VERY SMALL PROPORTION OF THE LITTERBAGS HANDED OUT END UP IN PARK TRASH CANS. FURTHERMORE, MOST OF THE REMAINING LITTERBAGS ARE CARRIED AWAY UNUSED FROM THE PARK. OF THE TWO TYPES OF LITTERBAGS TESTED, PLASTIC BAGS WERE USED MORE OFTEN THAN PAPER BAGS.
KEYWORDS. LITTER (PUBLIC PLACES).

HENDEE, JOHN C. 05 72036
CHALLENGING THE FOLKLORE OF ENVIRONMENTAL EDUCATION.
J. ENVIRON. EDUC. 3(3), P. 19-23.
PROPOSALS INCLUDE THREE OBJECTIVES FOR ENVIRONMENTAL EDUCATION, TWO SUGGESTIONS FOR ACTIVITY TO INITIATE MORE RELEVANT ENVIRONMENTAL EDUCATION RESEARCH, AND SEVERAL BASIC RESEARCH ISSUES.
KEYWORDS. ENVIRONMENT, EDUCATION, NATURAL RESOURCE CONSERVATION, RESEARCH.

HENDEE, JOHN C. 05 72048
NO, TO ATTITUDES TO EVALUATE ENVIRONMENTAL EDUCATION.
J. ENVIRON. EDUC. 3(3), INSIDE BACK COVER.
THIS GUEST EDITORIAL OPPOSES, ON TECHNICAL AND PHILOSOPHICAL GROUNDS, ATTITUDE MEASURES TO EVALUATE ENVIRONMENTAL EDUCATION AND PROPOSES EVALUATION MEASURING THE INFORMATION TRANSMITTED AND ITS IMPACT ON BEHAVIOR.
KEYWORDS. ATTITUDES, RECREATION, PSYCHOLOGY, ENVIRONMENT.

WAGAR, J. ALAN 9 72098
THE RECORDING QUIZBOARD--A DEVICE FOR EVALUATING INTERPRETIVE SERVICES.
USDA FOREST SERV. RES. PAP. PNW-139, 12 P., ILLUS.
DESCRIBES DESIGN AND USE OF RECORDING QUIZBOARD WHICH RECORDS RIGHT AND WRONG ANSWERS TO QUESTIONS BASED ON VISITOR CENTER EXHIBITS. THIS HELPS DETERMINE HOW WELL EXHIBIT MESSAGES ARE REACHING VISITORS. INITIAL RESULTS INDICATE THAT TAPED MESSAGES ARE MORE EFFECTIVE THAN THOSE A VISITOR MUST READ.
KEYWORDS. EXHIBITS, EDUCATION, NATURAL HISTORY.

REGENERATION

COCHRAN, P. H. 06 72061
TEMPERATURE AND SOIL FERTILITY AFFECT LODGEPOLE AND PONDEROSA PINE SEEDLING GROWTH.
FOREST SCI. 18(2), P. 132-134, ILLUS.
FERTILIZATION INCREASED GROWTH OF BOTH SPECIES UNDER ALL NINE TEMPERATURE REGIMES. LODGEPOLE WAS NOT AS SENSITIVE TO CHANGES IN NIGHT TEMPERATURE AS WAS PONDEROSA PINE. THE NUMBER OF DAILY DEGREE HOURS REQUIRED FOR MAXIMUM GROWTH CHANGED WITH BOTH SOIL FERTILITY LEVEL AND NIGHT TEMPERATURE.
KEYWORDS. 'PINUS PONDEROSA,' PONDEROSA PINE, 'PINUS CONTORTA,' LODGEPOLE PINE, TEMPERATURE, SOIL FERTILITY.

COCHRAN, P. H. 11 72191
TOLERANCE OF LODGEPOLE AND PONDEROSA PINE SEEDS AND SEEDLINGS TO HIGH WATER TABLES.
NORTHWEST SCI. 46(4), P. 322-331, ILLUS.
SOIL WATER LEVELS CLOSE TO SATURATION FAVORED GERMINATION OF LODGEPOLE OVER PONDEROSA PINE. WHEN 2-WEEK-OLD SEEDLINGS WERE SUBJECTED TO SEVERAL DIFFERENT SOIL WATER LEVELS, BOTH SPECIES SURVIVED AND GREW EVEN ON SATURATED SOILS. INFLUENCE OF HIGH SOIL WATER LEVELS ON SURVIVAL AND EARLY GROWTH OF THE TWO SPECIES IS PROBABLY NOT A FACTOR GOVERNING 'WET-SITE' OCCUPANCY BY LODGEPOLE PINE ON MINERAL SOILS.
KEYWORDS. SEEDS, SEEDLINGS, LODGEPOLE PINE, PONDEROSA PINE, SOIL MOISTURE.

EDGREN, JAMES W. 02 72019
FIELD SURVIVAL POOR FOR STORED AND HEELED-IN PONDEROSA PINE SEEDLINGS.
USDA FOREST SERV. TREE PLANTERS' NOTES 23(1), P. 19-20.
A YEAR AFTER FIELD PLANTING IN APRIL, SURVIVAL OF 3-0 PONDEROSA PINE SEEDLINGS THAT HAD BEEN FRESHLY LIFTED AVERAGED 57 PERCENT COMPARED WITH 18 PERCENT FOR THOSE LIFTED THE PREVIOUS NOVEMBER AND HELD IN COLD STORAGE FOR 19 WEEKS. SURVIVAL WAS 32 PERCENT FOR THOSE STORED 5 WEEKS AND THEN HEELED IN AT THE NURSERY FOR 14 WEEKS AND 24 PERCENT FOR THOSE STORED 16 WEEKS AND HEELED IN FOR 3 WEEKS PRIOR TO PLANTING.
KEYWORDS. NURSERY STOCK (FORESTRY), SEEDLINGS, PONDEROSA PINE.

GRATKOWSKI, H. 12 72201
SORPTION OF DEERBRUSH ('CEANOTHUS') SEEDS. (ABSTR.)
WEST. SOC. WEED SCI. RES. PROG. REP. 1972, P. 25. (NO COPIES AVAILABLE)
KEYWORDS. SEED DORMANCY, SEED GERMINATION, CEANOTHUS.

HARRIS, A. S. 05 72073
NATURAL REFORESTATION AFTER LOGGING ON AFOGNAK ISLAND.
USDA FOREST SERV. RES. NOTE PNW-176, 11 P., ILLUS.
TWENTY-FIVE YEARS AFTER LOGGING, SOME AREAS OF A CUTTING UNIT WERE STILL DOMINATED BY GRASS-HERBACEOUS VEGETATION AND RATE OF GROWTH OF TREE SEEDLINGS WAS SLOW. IF CONDITIONS DESCRIBED HERE PROVE TO BE TYPICAL, MEASURES TO CONTROL COMPETING VEGETATION WILL BE NECESSARY TO INSURE ADEQUATE REFORESTATION ON AFOGNAK ISLAND.
KEYWORDS. NATURAL REGENERATION (FORESTS), SITKA SPRUCE, LOGGING.

MINORE, DON 8 72093
GERMINATION AND EARLY GROWTH OF COASTAL TREE SPECIES ON ORGANIC SEED BEDS.
USDA FOREST SERV. RES. PAP. PNW-135, 18 P., ILLUS.
TYPE OF ORGANIC SEED BED PROBABLY DOES NOT AFFECT SPECIES COMPOSITION OF FOREST REGENERATION UNDER COASTAL SHELTERWOOD STANDS. PRESERVING DUFF ACCUMULATIONS UNDER SHADED CONDITIONS BENEFITS EARLY GROWTH OF ALL CONIFER SPECIES.
KEYWORDS. SEED GERMINATION, GROWTH FACTORS.

OUSTON (OWSTON), PEYTON W., AND WILLIAM I. STEIN 08 72166
COATING MATERIALS PROTECT DOUGLAS-FIR AND NOBLE FIR SEEDLINGS AGAINST DRYING CONDITIONS.
USDA FOREST SERV. TREE PLANT. NOTES 23(3), P. 21-23.
THREE COATING MATERIALS, CLAY SLURRY, XANTHAN GUM, AND SODIUM ALGINATE, PROTECTED ROOTS OF FRESHLY LIFTED DOUGLAS-FIR AND NOBLE FIR SEEDLINGS DURING 40 MINUTES EXPOSURE TO DRYING CONDITIONS. THEY ARE NOT YET RECOMMENDED, HOWEVER, FOR COATING ROOTS OF SEEDLINGS DESTINED FOR EXTENDED STORAGE.
KEYWORDS. NURSERY STOCK (FORESTRY), SEEDLINGS, ROOTS, DOUGLAS-FIR, 'PSEUDOTSUGA MENZIESII,' NOBLE FIR, 'ABIES PROCERA.'

OWSTON, PEYTON W., AND WILLIAM I. STEIN 04 72037
FIRST-YEAR PERFORMANCE OF DOUGLAS-FIR AND NOBLE FIR OUTPLANTED IN LARGE CONTAINERS.
USDA FOREST SERV. RES. NOTE PNW-174, 10 P., ILLUS.
DOUGLAS-FIR AND NOBLE FIR SEEDLINGS WERE POTTED INTO FOUR KINDS OF CONTAINERS, GROWN OUTDOORS FOR SEVERAL MONTHS, AND OUTPLANTED IN FALL AND SPRING. FIRST-YEAR SURVIVAL AND HEIGHT GROWTH OF CONTAINERIZED TREES WERE SIGNIFICANTLY BETTER THAN FOR 1-1 TRANSPLANTS AND 2-0 SEEDLINGS.
KEYWORDS. TRANSPLANTS, SEEDLINGS, CONTAINER STOCK, SEEDLING SURVIVAL, SEEDLING HEIGHT GROWTH, PLANTING SEASON, SEEDLING SUCCULENCE, TRANSPLANT SHOCK, DOUGLAS-FIR, 'PSEUDOTSUGA MENZIESII,' NOBLE FIR, 'ABIES PROCERA.'

STEIN, WILLIAM I. 12 71205
1971 LISTING OF SELECTED PUBLICATIONS ON REFORESTATION.
IN 'WESTERN REFORESTATION.' WEST. REFOR. COORD. COMM. PROC. 1971, P. 61-71.
A COMPILED LIST OF RECENT PUBLICATIONS ON ANY PHASE OF REFORESTATION IN THE WESTERN UNITED STATES AND CANADA PLUS ADDITIONAL PERTINENT REFERENCES FROM THE WORLDWIDE LITERATURE.
KEYWORDS. REFORESTATION.

*WILSON, BOYD C., AND ROBERT K. CAMPBEL (CAMPBELL) 5 72066
SEEDBED DENSITY INFLUENCES HEIGHT, DIAMETER, AND DRY WEIGHT OF 3-0 DOUGLAS-FIR.
USDA FOREST SERV. TREE PLANT. NOTES 23(2), ILLUS.
GROWING DOUGLAS-FIR 3-0 SEEDLINGS AT EIGHT TO 10 SEEDLINGS PER SQUARE FOOT IS SUGGESTED TO PRODUCE OPTIMUM PLANTING STOCK.
KEYWORDS. DOUGLAS-FIR, NURSERY STOCK (FORESTRY), SEEDLINGS, SEEDBEDS.

ZASADA, JOHN C. 07 72075
GUIDELINES FOR OBTAINING NATURAL REGENERATION OF WHITE SPRUCE IN ALASKA.
PAC. NORTHWEST FOREST AND RANGE EXP. STN., 16 P.
BASIC REQUIREMENTS FOR NATURAL REGENERATION OF WHITE SPRUCE ARE OUTLINED. METHODS ARE RECOMMENDED FOR CREATING CONDITIONS WHICH MEET THESE REQUIREMENTS, AND SURVEY TECHNIQUES ARE SUMMARIZED FOR DETERMINING ADEQUACY OF SEEDBED PREPARATION AND REGENERATION. THE GUIDELINES ARE BASED ON RESEARCH CONDUCTED IN WESTERN WHITE SPRUCE FORESTS OF CANADA AND MINIMAL ALASKAN OBSERVATIONS AND RESEARCH.
KEYWORDS. FOREST REGENERATION (NATURAL), WHITE SPRUCE, 'PICEA GLAUCA,' TIMBER MANAGEMENT.

ZASADA, JOHN C., AND ROBERT A. GREGORY* 6 72086
PAPER BIRCH SEED PRODUCTION IN THE TANANA VALLEY, ALASKA.
USDA FOREST SERV. RES. NOTE PNW-177, 7 P., ILLUS.
BASED ON SEEDFALL UNDER UNDISTURBED STANDS, DATA ARE PRESENTED FOR THE QUANTITY AND QUALITY OF SEED CROPS PRODUCED BY FOUR 'BETULA PAPYRIFERA' STANDS NEAR FAIRBANKS, ALASKA, FOR THE PERIOD 1958-63.
KEYWORDS. FOREST SEED PRODUCTION, PAPER BIRCH, 'BETULA PAPYRIFERA.'

RESIDUES

CHOATE, GROVER A. 07 72059
FLOWS OF MILL RESIDUES TO PULP AND BOARD MANUFACTURERS, WASHINGTON, OREGON, AND CALIFORNIA, 1968.
USDA FOREST SERV. RESOUR. BULL. PNW-39, 49 P., ILLUS.
OF THE 10 MILLION TONS OF RESIDUES SHIPPED FROM LUMBER AND VENEER AND PLYWOOD MILLS TO DOMESTIC PULP AND BOARD MILLS IN 1968, HALF WENT BY TRUCK (AVERAGE DISTANCE 37 MILES). ONE-FOURTH OF THE SHIPMENTS WERE BETWEEN MILLS OF THE SAME OWNERSHIP. TRUCKING WAS OF GREATER IMPORTANCE FOR SHIPMENTS FROM SMALL SAWMILLS THAN FROM LARGE.
KEYWORDS. FREIGHT TRANSPORTATION, PULPMILLS, SAWMILLS, MANUFACTURING.

HALL, J. ALFRED 04 72032
FOREST FUELS, PRESCRIBED FIRE, AND AIR QUALITY.
PAC. NORTHWEST FOREST AND RANGE EXP. STN., 44 P.
PRESCRIBED BURNING, PLANNED REMOVAL, UNDER CONTROLLED CONDITIONS, OF FOREST FUELS AS THREATS OF DISASTER, PRODUCES MOSTLY MATERIALS INTERFERING WITH VISIBILITY BUT NOT DANGEROUS TO HUMAN HEALTH. WITH PROPER MANAGEMENT BY TRAINED MEN, EVEN THIS SMALL COST TO ENVIRONMENT CAN BE MUCH REDUCED.
KEYWORDS. PRESCRIBED BURNING, FOREST ECOLOGY, ENVIRONMENT, SMOKE.

HOWARD, JAMES O., AND FRANKLIN R. WARD 8 72160
MEASUREMENT OF LOGGING RESIDUE--ALTERNATIVE APPLICATIONS OF THE LINE INTERSECT METHOD.
USDA FOREST SERV. RES. NOTE PNW-183, 8 P., ILLUS.
THE LINE INTERSECT METHOD OF MEASURING LOGGING RESIDUES WAS ANALYZED USING 200-FOOT SEGMENTS OF SAMPLE LINE LOCATED ON A SYSTEMATIC GRID-POINT SYSTEM. THREE CONFIGURATIONS OF SAMPLE LINE WERE TESTED WITH THE RESULTS INDICATING THE BEST PATTERN TO USE UNDER DIFFERENT LOGGING AND TOPOGRAPHIC CONDITIONS.
KEYWORDS. WASTE, MEASUREMENT, LOGGING, CUTOVER FORESTS.

SOILS, SITE, AND GEOLOGY

BUFFO, JOHN, LEO J. FRITSCHEN, AND JAMES L. MURPHY 12 72221
DIRECT SOLAR RADIATION ON VARIOUS SLOPES FROM 0 TO 60 DEGREES NORTH LATITUDE.
USDA FOREST SERV. RES. PAP. PNW-142, 74 P. ILLUS.
DIRECT BEAM SOLAR RADIATION IS PRESENTED IN GRAPHICAL AND TABULAR FORM FOR HOURLY, DAILY, AND YEARLY VALUES FOR SEVEN SLOPES ON EACH OF 16 ASPECTS FROM THE EQUATOR TO 60 DEGREES NORTH IN 10-DEGREE INCREMENTS. THEORETICAL EQUATIONS NECESSARY FOR THE CALCULATIONS ARE GIVEN. SOLAR ALTITUDE AND AZIMUTH DURING THE DAY AND YEAR ARE ALSO PRESENTED FOR THE SAME LATITUDES.
KEYWORDS. SOLAR RADIATION, SLOPES, ASPECTS.

DYRNESS, C. T. 7 72161
SOIL SURFACE CONDITIONS FOLLOWING BALLOON LOGGING.
USDA FOREST SERV. RES. NOTE PNW-182, 7 P., ILLUS.
BALLOON LOGGING CAUSED SUBSTANTIALLY LESS SOIL DISTURBANCE THAN PREVIOUS STUDIES HAD SHOWN FOR TRACTOR, HIGHLEAD, AND SKYLINE LOGGING METHODS. DEEPLY DISTURBED AND COMPACTED SOIL AREAS OCCUPIED 4.3 PERCENT OF THE TOTAL AREA, AND 15.8 PERCENT OF THE AREA WAS CLASSED AS SLIGHTLY DISTURBED.
KEYWORDS. LOGGING, FOREST CUTTING SYSTEMS, SOIL CONSERVATION.

KLOCK, GLEN O. 02 72007
SNOWMELT TEMPERATURE INFLUENCE ON INFILTRATION AND SOIL WATER RETENTION.
J. SOIL AND WATER CONSERV. 27(1), P. 12-14, ILLUS.
EFFECT OF SNOWMELT WATER ON INFILTRATION AND SOIL WATER RETENTION IS SHOWN BY THEORY AND EXPERIMENTATION. WATERSHED MANAGEMENT IMPLICATIONS INVOLVED INCLUDING RECOGNIZING POSSIBLE OVERLAND FLOW HAZARDS AND EFFECTS OF THINNING, CLEARCUTTING, AND WILDFIRE ARE DISCUSSED.
KEYWORDS. TEMPERATURE, SNOW, SOIL INFILTRATION, SOIL MOISTURE, HYDROLOGY.

KLOCK, GLEN O., AND WALTER A. HAMPTON. 01 72001
SKIING--'AND ON GRASS BASE.'
WASH. FARMER-STOCKMAN 97(2), P. 34, ILLUS.
THE SUCCESSFUL PLANTING PROCEDURES DEVELOPED HERE WOULD BE ADAPTABLE TO REVEGETATE SKI SLOPES AND OTHER DISTURBED AREAS IN MANY PLACES ALONG THE UPPER SLOPES OF THE CASCADE MOUNTAINS.
KEYWORDS. SOIL MANAGEMENT, SPORTS.

MERSEREAU, R. C., AND C. T. DYRNESS 06 72064
ACCELERATED MASS WASTING AFTER LOGGING AND SLASH BURNING.
J. SOIL AND WATER CONSERV. 27(3), P. 112-114, ILLUS.
CLEARCUT LOGGING AND SLASH BURNING IN A STEEP WATERSHED IN WESTERN OREGON RESULTED IN INCREASED RATES OF SOIL MOVEMENT DURING THE FIRST YEAR AFTER BURNING. MEASURED SOIL AND ROCK MOVEMENT OCCURRED LARGELY DURING THE DRY SEASON, AND AMOUNTS WERE CLOSELY TIED TO SLOPE STEEPNESS, ASPECT, VEGETATIVE COVER, AND LENGTH OF TIME SINCE BURNING.
KEYWORDS. SOIL STABILIZATION, LOGGING, FOREST CLEARCUTTING, SLASH.

OKAZAKI, ROSE, HENRY W. SMITH, RAYMOND A. GILKESON,* AND JERRY FRANKLIN 05 72063
CORRELATION OF WEST BLACKTAIL ASH WITH PYROCLASTIC LAYER T FROM THE 1800 A.D. ERUPTION OF MOUNT ST. HELENS.
NORTHWEST SCI. 46(2), P. 77-89, ILLUS. (NO COPIES AVAILABLE)
REPORT DOCUMENTS LAYER T BEYOND THE PREVIOUS RECOGNIZED LIMITS, CORRELATION WITH WEST BLACKTAIL ASH, AND RELATIONSHIP OF BOTH WITH SOIL HORIZONATION.
KEYWORDS. VOLCANIC ASH, SOIL PROFILES.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 5 72068
SOIL STABILITY AND STREAMFLOW.
2 P., ILLUS.
THE FOLDER GIVES GENERAL INFORMATION ON PERSONNEL, NATURE OF THE STUDIES, PUBLICATIONS, AND ILLUSTRATIONS OF THE RESEARCH PROJECT.
KEYWORDS. STREAM GAGING, PRECIPITATION, TIMBER MANAGEMENT, SOIL STABILIZATION.

RICE, R. M., J. S. ROTHACHER, AND W. F. MEGAHAN 06 72174
EROSIONAL CONSEQUENCES OF TIMBER HARVESTING--AN APPRAISAL.
'IN' WATERSHEDS IN TRANSITION.
PROC., AM. WATER RESOUR. ASSOC. AND COLO. STATE UNIV., P. 321-329. (NO COPIES AVAILABLE)
THIS PAPER SUMMARIZES OUR CURRENT UNDERSTANDING OF THE EFFECTS OF TIMBER HARVESTING ON EROSION.
KEYWORDS. LOGGING, SOIL EROSION, LANDSLIDES, WATERSHED MANAGEMENT.

SWANSTON, DOUGLAS N. 12 71206
JUDGING IMPACT AND DAMAGE OF TIMBER HARVESTING TO FOREST SOILS IN MOUNTAINOUS REGIONS OF WESTERN NORTH AMERICA.
'IN' WESTERN REFORESTATION. WEST. REFOR. COORD. COMM. PROC. 1971, P. 14-19.
SLOPE DISTURBANCE PRODUCED BY FOREST OPERATIONS ON MOUNTAINOUS TERRAIN HAS BEEN IDENTIFIED AS A MAJOR CONTRIBUTOR TO INITIATION AND ACCELERATION OF EROSION BY SOIL MASS MOVEMENT PROCESSES. ROADBUILDING IS THE MOST DAMAGING OPERATION, BUT TIMBER CUTTING AND SLASH BURNING ARE EFFECTIVE INITIATORS IN LOCAL AREAS. FACTORS CONTROLLING SLOPE STABILITY AND CURRENT TECHNIQUES FOR IDENTIFICATION AND CONTROL ARE DISCUSSED.
KEYWORDS. SOIL EROSION, LOGGING.

TIEDEMANN, ARTHUR R. 11 72194
SOIL PROPERTIES AND NUTRIENT AVAILABILITY IN TARWEED COMMUNITIES OF CENTRAL WASHINGTON.
J. RANGE MANAGE. 25(6), P. 438-443, ILLUS.
COMPARISON OF SOIL NUTRIENT LEVELS AND CERTAIN SOIL PHYSICAL PROPERTIES BETWEEN TARWEED COMMUNITIES AND ADJACENT STABLE, PRODUCTIVE NEEDLEGRASS COMMUNITIES INDICATED A LOWER NUTRIENT CAPITAL OF N, S, AND EXCHANGEABLE MN AND POORER PHYSICAL CONDITION IN THE TARWEED COMMUNITIES. POT STUDIES WITH MOUNTAIN BROME AND ORCHARD GRASS REVEALED LOW AVAILABILITY OF N, S, AND P IN SOILS FROM TARWEED COMMUNITIES AND SUGGEST A NEED TO AMEND NATIVE SOIL NUTRIENTS WITH THESE ELEMENTS.
KEYWORDS. SOIL NUTRIENTS, SOIL MANAGEMENT, COLUMBIA NEEDLEGRASS, 'STIPA COLUMBIANA,' CLUSTER TARWEED, 'MADIA GLOMERATA.'

WALKOTTEN, WILLIAM J. 6 72087
A RECORDING SOIL MOISTURE TENSIOMETER.
USDA FOREST SERV. RES. NOTE PNW-180, 12 P., ILLUS.
A RECORDING WATER-SATURATED POROUS CUP TENSIOMETER IS DESCRIBED THAT OPERATES IN THE NEGATIVE PRESSURE RANGE OF A MERCURY MANOMETER-TYPE TENSIOMETER AND PROVIDES A CONTINUOUS RECORD OF SOIL MOISTURE TENSION FOR PERIODS UP TO 31 DAYS.
KEYWORDS. TENSIOMETER, SOIL MOISTURE, SOIL MANAGEMENT.

SUPPLY AND DEMAND

DARR, DAVID R. 04 72012
PRODUCTION, PRICES, EMPLOYMENT, AND TRADE IN NORTHWEST FOREST INDUSTRIES, FOURTH QUARTER 1971.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STA., 55 P., ILLUS.
PROVIDES CURRENT INFORMATION ON LUMBER AND PLYWOOD PRODUCTION AND PRICES, EMPLOYMENT IN THE FOREST INDUSTRIES, INTERNATIONAL TRADE IN LOGS, LUMBER AND PLYWOOD, VOLUME AND AVERAGE PRICES OF STUMPAGE SOLD BY PUBLIC AGENCIES, AND OTHER RELATED ITEMS.
KEYWORDS. FORESTRY PRODUCTION ECONOMICS, LUMBER PRICES, PLYWOOD PRICES, LUMBER TRADE, EMPLOYMENT, FOREST INDUSTRIES.

DARR, DAVID R. 05 72045
PRODUCTION, PRICES, EMPLOYMENT, AND TRADE IN NORTHWEST FOREST INDUSTRIES, FIRST QUARTER 1972.
PACIFIC NORTHWEST FOREST AND RANGE EXP. STN., 29 P., ILLUS.
PROVIDES CURRENT INFORMATION ON LUMBER AND PLYWOOD PRODUCTION AND PRICES, EMPLOYMENT IN THE FOREST INDUSTRIES, INTERNATIONAL TRADE IN LOGS, LUMBER, AND PLYWOOD, VOLUME AND AVERAGE PRICES OF STUMPAGE SOLD BY PUBLIC AGENCIES, AND OTHER RELATED ITEMS.
KEYWORDS. FORESTRY BUSINESS ECONOMICS, LUMBER, PLYWOOD, MARKETING, LOG EXPORTS.

HOLT, ED 9 72165
PRODUCTION, PRICES, EMPLOYMENT, AND TRADE IN NORTHWEST FOREST INDUSTRIES, SECOND QUARTER 1972.
PAC. NORTHWEST FOREST AND RANGE EXP. STN., 55 P., ILLUS.
PROVIDES CURRENT INFORMATION ON LUMBER AND PLYWOOD PRODUCTION AND PRICES, EMPLOYMENT IN THE FOREST INDUSTRIES, INTERNATIONAL TRADE IN LOGS, LUMBER, AND PLYWOOD, VOLUME AND AVERAGE PRICES OF STUMPAGE SOLD BY PUBLIC AGENCIES, AND OTHER RELATED ITEMS.
KEYWORDS. FORESTRY BUSINESS ECONOMICS, LUMBER, PLYWOOD, TIMBER VOLUME, STUMPAGE SALES, EMPLOYMENT, MARKETING, LOG EXPORTS.

HOLT, ED 12 72192
PRODUCTION, PRICES, EMPLOYMENT, AND TRADE IN NORTHWEST FOREST INDUSTRIES, THIRD QUARTER 1972.
PAC. NORTHWEST FOREST AND RANGE EXP. STN., 54 P., ILLUS.
PROVIDES CURRENT INFORMATION ON LUMBER AND PLYWOOD PRODUCTION AND PRICES, EMPLOYMENT IN THE FOREST INDUSTRIES, INTERNATIONAL TRADE IN LOGS, LUMBER, AND PLYWOOD, VOLUME AND AVERAGE PRICES OF STUMPAGE SOLD BY PUBLIC AGENCIES, AND OTHER RELATED ITEMS.
KEYWORDS. FORESTRY BUSINESS ECONOMICS, LUMBER, PLYWOOD, TIMBER VOLUME, STUMPAGE SALES, EMPLOYMENT, MARKETING, LOG EXPORTS.

LANE, PAUL H., RICHARD O. WOODFIN, JR., JOHN W. HENLEY, AND MARLIN E. PLANK 07 72071
LUMBER YIELD FROM SITKA SPRUCE IN SOUTHEASTERN ALASKA.
USDA FOREST SERV. RES. PAP. PNW-134, 44 P., ILLUS.
ABOUT 98 PERCENT OF THE SITKA SPRUCE LUMBER SAWN IN A SOUTHEASTERN ALASKA LUMBER RECOVERY STUDY WAS IN CANTS 3 TO 8 INCHES IN THICKNESS. THIRTEEN PERCENT OF THE LUMBER VOLUME WAS GRADED NO. 2 AND 3 CLEAR BY THE PACIFIC LUMBER INSPECTION BUREAU RULES AND 9 PERCENT PIANO UNDER EXPORT RULES.
KEYWORDS. LUMBER TRADE, FOREST INDUSTRIES, SITKA SPRUCE, SOUTHEAST ALASKA.

OSWALD, DANIEL D. 8 72084
TIMBER RESOURCES OF MENDOCINO AND SONOMA COUNTIES, CALIFORNIA.
USDA FOREST SERV. RESOUR. BULL. PNW-40, 76 P., ILLUS.
THIS REPORT PRESENTS THE FINDINGS OF THE FIRST COMPLETE INVENTORY OF THE TIMBER RESOURCES OF MENDOCINO AND SONOMA COUNTIES, CALIFORNIA. ACCOMPANYING THE TABLES OF DETAILED FOREST AREA, VOLUME, GROWTH, AND MORTALITY STATISTICS IS AN ANALYSIS OF THE PRESENT TIMBER RESOURCE, WITH EMPHASIS ON CONDITIONS THAT AFFECT PRESENT AND FUTURE TIMBER PRODUCTION.
KEYWORDS. FOREST SURVEYS, TIMBER, STAND VOLUME ESTIMATES, MENDOCINO COUNTY, SONOMA COUNTY, CALIFORNIA.

WALL, BRIAN R. 11 72184
LOG PRODUCTION IN WASHINGTON AND OREGON. AN HISTORICAL PERSPECTIVE.
USDA FOREST SERV. RESOUR. BULL. PNW-42, 89 P., ILLUS.
THIS REPORT EXAMINES AND GRAPHICALLY PORTRAYS THE HISTORIC TRENDS IN OREGON AND WASHINGTON LOG PRODUCTION BY REGION, STATE, COUNTY, AND FOREST-LAND OWNERSHIP FOR 1925-70.
KEYWORDS. ECONOMIC HISTORY, FOREST PRODUCTS, LOGGING.

WALL, BRIAN R. 07 72077
1971 OREGON TIMBER HARVEST.
USDA FOREST SERV. RESOUR. BULL. PNW-43, 2 P., ILLUS.
CHRONICLES TIMBER HARVEST FOR 1951-1971 AND GIVES DETAIL BY COUNTIES FOR 1971.
KEYWORDS. TIMBER STATISTICS, OREGON.

WALL, BRIAN R. 06 72056
1971 WASHINGTON TIMBER HARVEST.
USDA FOREST SERV. RESOUR. BULL. PNW-41, 2 P., ILLUS.
CHRONICLES TIMBER HARVEST FOR 1951-1971 AND GIVES DETAIL BY COUNTIES FOR 1971.
KEYWORDS. TIMBER STATISTICS, WASHINGTON.

WALL, BRIAN R. 12 72222
RELATIONSHIP OF LOG PRODUCTION IN OREGON AND WASHINGTON TO ECONOMIC CONDITIONS.
USDA FOREST SERV. RES. PAP. PNW-147, 13 P., ILLUS.
FLUCTUATIONS IN OREGON AND WASHINGTON LOG PRODUCTION HAVE RESULTED FROM CHANGES IN THE NATIONAL DEMAND FOR WOOD PRODUCTS DURING THE 1949-69 PERIOD. CHANGES IN HOUSING STARTS, LAGGED 1 YEAR, ARE SIGNIFICANTLY RELATED TO ANNUAL LOG PRODUCTION AND STUMPAGE PRICES.
KEYWORDS. FORESTRY BUSINESS ECONOMICS, TIMBER, HOUSING, FOREST APPRAISAL.

TIMBER MANAGEMENT

BARRETT, JAMES W. 5 72088
LARGE-CROWNED PLANTED PONDEROSA PINE RESPOND WELL TO THINNING.
USDA FOREST SERV. RES. NOTE PNW-179, 12 P., ILLUS.
SIZABLE REDUCTIONS IN GROWING STOCK ARE FEASIBLE IN OVERSTOCKED PONDEROSA PINE PLANTATIONS WHERE TREE CROWNS ARE WELL FORMED AND FULL. THIRTY-YEAR-OLD PLANTED STANDS THINNED TO 140 TREES PER ACRE PRODUCED ABOUT THE SAME VOLUME AS SIMILAR THINNED STANDS CONTAINING FOUR TIMES AS MANY TREES.
KEYWORDS. THINNING (TREES), STAND DENSITY, PONDEROSA PINE, FOREST IMPROVEMENT CUTTING.

BELL, JOHN F., AND ALAN B. BERG 05 72039
LEVELS-OF-GROWING-STOCK COOPERATIVE STUDY ON DOUGLAS-FIR, REPORT NO. 2--THE HOSKINS STUDY, 1963-1970.
USDA FOREST SERV. RES. PAP. PNW-130, 19 P., ILLUS.
THINNING REGIMES IN A YOUNG DOUGLAS-FIR STAND NEAR HOSKINS, OREGON, ARE DESCRIBED. DATA ARE TABULATED FOR THE FIRST 7 YEARS OF MANAGEMENT.
KEYWORDS. THINNINGS, STAND GROWTH, DOUGLAS-FIR, FOREST IMPROVEMENT CUTTING.

BRUCE, DAVID 09 72177
MANAGEMENT OF DOUGLAS-FIR IN EUROPE. 'IN' ALAN B. BERG (ED.), MANAGING YOUNG FORESTS IN THE DOUGLAS-FIR REGION. SCH. FOR., OREG. STATE UNIV., VOL. 3, P. 1-15, ILLUS. (NO COPIES AVAILABLE)
SUMMARIZES HISTORY, LOCATION, CLIMATE, AND VARIETIES OF DOUGLAS-FIR PLANTED IN EUROPE. DISCUSSES EUROPEAN PRODUCTION TABLES (THINNING GUIDES) AND ILLUSTRATES FIVE DIFFERENT THINNING REGIMES FOR DOUGLAS-FIR FOUND IN RECENT EUROPEAN LITERATURE.
KEYWORDS. DOUGLAS-FIR, FOREST MANAGEMENT, EUROPE, THINNING.

BUCKMAN, ROBERT E. 12 71218
ON RESEARCH NEEDS FOR FUTURE FOREST MANAGEMENT. 'IN' WESTERN FORESTRY SPEAKS.
PROC. 62ND WEST. FOR. CONF., P. 63-67
FOREST SERVICE RESEARCH MUST MEASURE THE MULTIPLE RESOURCES, EXPLORE ALTERNATIVE USES, AND PREDICT CONSEQUENCES OF VARIOUS MANAGEMENT CHOICES.
KEYWORDS. FOREST MANAGEMENT, RESEARCH, NATURAL RESOURCES.

DAHMS, WALTER G. 12 71208
GROWTH AND SOIL MOISTURE IN THINNED LODGEPOLE PINE.
USDA FOREST SERV. RES. PAP. PNW-127, 32 P., ILLUS.
A LODGEPOLE PINE LEVELS-OF-GROWING-STOCK STUDY SHOWED THAT INDIVIDUAL TREES DEVELOPED LONGER CROWNS, GREW MORE RAPIDLY, AND ADDED MORE WOOD TO POTENTIALLY MERCHANTABLE TREES AT LOWER STAND DENSITIES, BUT TOTAL WOOD PRODUCTION WAS LESS. EVAPOTRANSPIRATION DRAIN ON SOIL MOISTURE WAS ALSO LESS AT THE LOWER STAND DENSITIES
KEYWORDS. SOIL MOISTURE, STAND DENSITY, LODGEPOLE PINE, FOREST MEASUREMENT.

*KOJIMA, MICHIMASA, AND J. ALAN WAGAR 05 72041
COMPUTER-GENERATED DRAWINGS OF GROUND FORM AND VEGETATION.
J. FOR. 70(5), P. 282-285, ILLUS.
DESCRIBES THE APPLICATION OF TWO COMPUTER PROGRAMS THAT GENERATE PERSPECTIVE VIEWS OF THE LANDSCAPE, PERMITTING THE VISUAL EFFECTS OF PROPOSED LANDSCAPE MODIFICATIONS TO BE EXAMINED.
KEYWORDS. LANDSCAPE MANAGEMENT, COMPUTERS.

MINORE, DON 8 72092
THE WILD HUCKLEBERRIES OF OREGON AND WASHINGTON--A DWINDLING RESOURCE.
USDA FOREST SERV. RES. PAP. PNW-143, 20 P., ILLUS.
THE 12 NORTHWESTERN 'VACCINIUM' SPECIES ARE DESCRIBED. MANAGEMENT PROBLEMS ARE OUTLINED, AND PERTINENT LITERATURE IS REVIEWED. EFFICIENT MANAGEMENT TECHNIQUES ARE UNKNOWN, BUT SOME OF THE METHODS USED IN MANAGING EASTERN BLUEBERRIES MAY BE APPLICABLE.
KEYWORDS. HUCKLEBERRIES, 'VACCINIUM' SP., BILBERRY, BLUEBERRY, WHORTLEBERRY, FOREST MANAGEMENT, FOREST BURNING, SOILS, HERBICIDES, PRUNING.

PACIFIC NORTHWEST FOREST AND RANGE EXP. STN. 04 72054
CULTURE OF MIXED CONIFERS, WEST-SIDE CASCADES.
2 P., ILLUS.
THE FOLDER GIVES GENERAL INFORMATION ON PERSONNEL, NATURE OF THE STUDIES, PUBLICATIONS, AND ILLUSTRATIONS OF THE RESEARCH PROJECT.
KEYWORDS. TIMBER MANAGEMENT, RESEARCH, FOREST MULTIPLE USE.

RANDALL, ROBERT M. 12 72219
AN OPERATIONS RESEARCH APPROACH TO DOUGLAS-FIR THINNING.
USDA FOREST SERV. RES. PAP. PNW-148, 23 P., ILLUS.
A ZERO-ONE INTEGER PROGRAMING PROCEDURE IS USED AS THE BASIS FOR A SYSTEMATIC FRAMEWORK FOR PLANNING COMMERCIAL THINNING OPERATIONS IN YOUNG-GROWTH DOUGLAS-FIR. THIS NEW APPROACH, TERMED 'THE UNIT APPROACH,' IS DEMONSTRATED, TESTED, AND COMPARED TO EXISTING RULE-OF-THUMB METHODS ON A CASE STUDY AREA IN WESTERN OREGON.
KEYWORDS. THINNING (TREES), PROGRAMING (COMPUTERS), DOUGLAS-FIR, FOREST MANAGEMENT.

REUKEMA, DONALD L. 10 72179
TWENTY-ONE-YEAR DEVELOPMENT OF DOUGLAS-FIR STANDS REPEATEDLY THINNED AT VARYING INTERVALS.
USDA FOREST SERV. RES. PAP. PNW-141, 23 P., ILLUS.
OVER AN 18-YEAR PERIOD, BEGINNING AT AGE 38, LIGHT THINNINGS AT 3-YEAR INTERVALS, MODERATE THINNINGS AT 6-YEAR INTERVALS, AND HEAVY THINNINGS AT 9-YEAR INTERVALS ALL REDUCED GROSS CUBIC VOLUME GROWTH BY ABOUT 20 PERCENT. THIS LOSS OF GROWTH WAS LARGELY OFFSET BY SALVAGE OF MORTALITY.
KEYWORDS. THINNING (TREES), FOREST IMPROVEMENT CUTTING, DOUGLAS-FIR.

SASSAMAN, ROBERT W., ED HOLT, AND KARL BERGSVIK* 11 72183
USER'S MANUAL FOR A COMPUTER PROGRAM FOR SIMULATING INTENSIVELY MANAGED ALLOWABLE CUT (SIMAC).
USDA FOREST SERV. GEN. TECH. REP. PNW-1, 50 P., ILLUS.
DETAILED OPERATING INSTRUCTIONS ARE DESCRIBED FOR SIMAC, A COMPUTERIZED FOREST SIMULATION MODEL WHICH CALCULATES THE ALLOWABLE CUT ASSUMING VOLUME REGULATION FOR FORESTS WITH INTENSIVELY MANAGED STANDS. A SAMPLE PROBLEM ILLUSTRATES THE REQUIRED INPUTS AND EXPECTED OUTPUT. SIMAC IS WRITTEN IN FORTRAN IV AND RUNS ON A CDC 6400 COMPUTER WITH A SCOPE 3.3 OPERATING SYSTEM. THE CONCEPTUAL BASIS OF THE SIMAC METHOD IS NOT DISCUSSED IN DETAIL.
KEYWORDS. ALLOWABLE CUT, PROGRAMING (COMPUTER).

SCHWEITZER, DENNIS L., ROBERT W. SASSAMAN, AND CON H. SCHALLAU 7 72079
ALLOWABLE CUT EFFECT--SOME PHYSICAL AND ECONOMIC IMPLICATIONS.
J. FOR. 70(7), P. 415-418, ILLUS.
THE ALLOWABLE CUT EFFECT IS INTRODUCED. SEVERAL PHYSICAL AND ECONOMIC CONSEQUENCES OF THE CONCEPT ARE ILLUSTRATED AND DISCUSSED.
KEYWORDS. ALLOWABLE CUT, TIMBER MANAGEMENT.

WILLIAMSON, RICHARD L. 03 72027
SHELTERWOOD HARVESTING DOUGLAS-FIR IN THE HIGH CASCADES OF WESTERN OREGON. (ABSTR.)
NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 15 (NO COPIES AVAILABLE)
KEYWORDS. SHELTERWOOD SYSTEM, FOREST REGENERATION (NATURAL), DOUGLAS-FIR, FOREST CUTTING SYSTEM.

WATER QUALITY

KLOCK, G. O. 03 72031
SOIL MOISTURE TRENDS ON MOUNTAIN WATERSHEDS FOLLOWING FOREST FIRE. (ABSTR.)
NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 7. (NO COPIES AVAILABLE)
KEYWORDS. FOREST FIRES, SOIL MOISTURE, WATERSHEDS.

KLOCK, G. O., AND W. B. FOWLER 09 72171
AN INEXPENSIVE WATER SAMPLER.
USDA FOREST SERV. RES. NOTE PNW-188, 6 P., ILLUS.
A STREAM SAMPLER WITH NO EXTERIOR ENERGY REQUIREMENTS OR MOVING PARTS HAS BEEN DESIGNED AND TESTED. A BASIC MODEL HAS BEEN DESCRIBED THAT HAS MANY OPTIONS TO FIT PARTICULAR SAMPLING NEEDS. BASIC COST OF THE UNIT, EXCLUDING SAMPLER MOUNTING AND STRUCTURES NEEDED TO PROVIDE STREAM CONTROL, IS LESS THAN $10.
KEYWORDS. WATER ANALYSIS, SAMPLE DESIGNS (FORESTRY), POISEUILLE'S LAW, STREAMS.

MOORE, D. G. 10 72159
EFFECTS OF FOREST FERTILIZATION WITH UREA ON STREAM WATER QUALITY. (ABSTR.) 'IN' AGRONOMY ABSTRACTS, 1972 MEETINGS.
AM. SOC. AGRON., P. 141. (NO COPIES AVAILABLE)
AERIAL FERTILIZATION OF A 169-ACRE FORESTED WATERSHED WITH UREA AT 200 POUNDS N/ACRE IN MARCH 1970 RESULTED IN A LOSS OF 0.34 POUND N/ACRE DURING THE FIRST YEAR AFTER APPLICATION. MAXIMUM CONCENTRATIONS OF APPLIED NITROGEN REACHING THE STREAM WERE NOT TOXIC TO AQUATIC ORGANISMS; AND THE APPLICATION OF UREA NITROGEN HAD NO APPARENT EFFECT ON LOSS OF NATIVE SOIL NITROGEN, PHOSPHORUS, CALCIUM, MAGNESIUM, OR POTASSIUM.
KEYWORDS. AERIAL FERTILIZATION, UREA, STREAMS, NITROGEN.

MOORE, DUANE G. 12 71207
FERTILIZATION AND WATER QUALITY.
'IN' WESTERN REFORESTATION. WEST. REFOR. COORD. COMM. PROC. 1971, P. 28-31.
FERTILIZATION OF FORESTED WATERSHEDS WITH UREA AT 200 POUNDS NITROGEN PER ACRE DID NOT RESULT IN TOXIC LEVELS OF AMMONIA- AND NITRATE-NITROGEN IN STREAMS DRAINING THE TREATED AREA, AND TOTAL AMOUNTS OF APPLIED NITROGEN ENTERING SURFACE WATERS WERE TOO SMALL TO HAVE A MEASURABLE IMPACT ON THE AQUATIC ENVIRONMENT. AVAILABLE DATA ANSWER SOME QUESTIONS ON WATER QUALITY, BUT THE LONG-TERM EFFECTS OF CHEMICAL FERTILIZERS ON THE FOREST ENVIRONMENT MUST STILL BE DETERMINED.
KEYWORDS. FERTILIZATION (PLANTS), WATER ANALYSIS, WATERSHED MANAGEMENT, ENVIRONMENT.

NORRIS, LOGAN A., AND DUANE G. MOORE 12 72203
THE ENTRY, FATE AND TOXICITY OF FOREST CHEMICALS IN STREAMS.
'IN' FORESTRY AND WATER QUALITY.
SCH. FOR., OREG. STATE UNIV., P. 45-67. (NO COPIES AVAILABLE)
FERTILIZERS, HERBICIDES, AND INSECTICIDES, ARE FOREST CHEMICALS WHICH MAY ENTER FOREST STREAMS BY DIRECT APPLICATION, DRIFT, OR MOVEMENT THROUGH THE SOIL. CAREFUL APPLICATION OF FOREST CHEMICALS CAN REDUCE THE AMOUNT AND RESIDENCE TIME OF CHEMICALS IN THE STREAM AND THEREBY MINIMIZE POTENTIAL HAZARD TO STREAM ORGANISMS.
KEYWORDS. STREAMS, CHEMICALS, ENVIRONMENT, ECOSYSTEM.

SWANK, WAYNE T., NORBERT B. GOEBEL, AND JUNIOR D. HELVEY 08 72106
INTERCEPTION LOSS IN LOBLOLLY PINE STANDS OF THE SOUTH CAROLINA PIEDMONT.
J. SOIL AND WATER CONSERV. 27(4), P. 160-164. (NO COPIES AVAILABLE)
ON THE AVERAGE, THE LOSS OF WATER INTERCEPTED ANNUALLY BY LOBLOLLY PINE APPEARED TO BE ABOUT 4 INCHES GREATER THAN THE LOSS ESTIMATED FROM A NUMBER OF HARDWOOD STUDIES. WHERE EXTENSIVE CONVERSIONS OF HARDWOOD TO LOBLOLLY PINE OCCUR, SIGNIFICANT REDUCTIONS IN THE AMOUNT OF WATER AVAILABLE FOR STREAMFLOW OR GROUNDWATER SHOULD BE EXPECTED.
KEYWORDS. PRECIPITATION INTERCEPTION, LOBLOLLY PINE, WATER RESOURCES.

TIEDEMANN, A. R. 03 72023
STREAM CHEMISTRY FOLLOWING THE SAFETY HARBOR FOREST FIRE AND EROSION CONTROL FERTILIZATION IN NORTH CENTRAL WASHINGTON. (ABSTR.)
NORTHWEST SCI. ASSOC. 45TH ANNU. MEET., P. 13. (NO COPIES AVAILABLE)
KEYWORDS. STREAMS, FOREST FIRES, WATERSHEDS, UREA.

WILDLIFE AND TIMBER

RADWAN, M. A. 09 72167
DIFFERENCES BETWEEN DOUGLAS-FIR GENOTYPES IN RELATION TO BROWSING PREFERENCE BY BLACK-TAILED DEER.
CAN. J. FOREST RES. 2(3), P. 250-255.
DIGESTIBILITY, ESSENTIAL OILS, AND LEVELS OF SELECTED CHEMICAL CONSTITUENTS WERE COMPARED IN FOLIAGE OF DOUGLAS-FIR GENOTYPES HAVING DIFFERENT SUSCEPTIBILITIES TO DEER BROWSING. RESULTS SUGGEST THAT ONE OR MORE OF THE DEER BROWSING RESISTANCE CHARACTERISTICS FOUND IN THE STUDY MIGHT BE USED TO SCREEN DOUGLAS-FIR BREEDING STOCK FOR RESISTANCE TO DEER BROWSING.
KEYWORDS. DOUGLAS-FIR, 'PSEUDOTSUGA MENZIESII,' BLACK-TAILED DEER, 'ODOCOILEUS HEMIONUS COLUMBIANUS,' BROWSE.

RADWAN, M. A. 08 72080
PHYSIOLOGICAL RESISTANCE TO MAMMALS. 'IN' SECOND NORTH AMERICAN FOREST BIOLOGY WORKSHOP. (ABSTR.)
OREG. STATE UNIV., SOC. AM. FOREST., PROGRAM ABSTR., P. 20. (NO COPIES AVAILABLE)
INDIVIDUAL AS WELL AS GROUPS OF CHEMICAL COMPOUNDS HAVE BEEN SUGGESTED AS CAUSES OF RESISTANCE OF FOREST TREES BECAUSE OF THEIR TOXICITY OR UNDESIRABLE EFFECTS ON AN ANIMAL'S TASTE, SMELL, NUTRITION, OR DIGESTION.
KEYWORDS. MAMMALS, PLANT PHYSIOLOGY, FEEDING.

WOOD UTILIZATION

ANONYMOUS 02 72005
PREDICTING DAMPING IN WOOD STRUCTURES.
FOREST PROD. J. 22, P. 59-60, ILLUS.
SMALL AMPLITUDE VIBRATIONS IN FLOORS OR OTHER ELEMENTS OF WOOD BUILDINGS CAN BE DAMPED EFFECTIVELY WITH PROPERLY CHOSEN NAILED AND GLUED JOINTS. THE REPORT REFERRED TO IN THIS TECHNICAL NOTE DEVELOPS METHODS FOR PREDICTING THE DAMPING OF STRUCTURES. ONLY SIMPLE TESTS ON SMALL SPECIMENS ARE NEEDED. THE THEORIES ARE CONFIRMED BY EXPERIMENTS ON SCALED STRUCTURAL MEMBERS.
KEYWORDS. STRUCTURAL DESIGN, WOOD STRUCTURES, VIBRATION.

GRANTHAM, J. B., AND T. B. HEEBINK 05 72035
INSURING NOISE CONTROL IN WOOD-FRAMED BUILDINGS.
FOREST PROD. J. 22(5), P. 36-43, ILLUS.
DESIGN AND CONSTRUCTION PRACTICES THAT PREVENT SOUND LEAKS AND FLANKING ARE DESCRIBED. THESE PRECAUTIONS INSURE THAT WOOD-FRAMED WALLS AND FLOORS WILL CONTROL NOISE TRANSMISSION BETWEEN APARTMENTS AS PREDICTED BY LABORATORY TESTS.
KEYWORDS. ACOUSTIC INSULATION, NOISE, CONSTRUCTION MATERIALS.

GRANTHAM, J. B., AND T. B. HEEBINK 12 72207
SOUND INSULATION IN A MODULAR MOTEL.
USDA FOREST SERV. RES. NOTE PNW-193, 8 P.
FIELD-MEASURED RESISTANCE TO SOUND TRANSMISSION IN A TWO-STORY MODULAR MOTEL ASSEMBLED FROM 102 FACTORY-BUILT, THREE-DIMENSIONAL WOOD-FRAMED UNITS WAS GENERALLY ACCEPTABLE. LABORATORY TESTS INDICATED THAT THE EXTERIOR SHEATHING, USED TO OBTAIN HIGH STRUCTURAL RIGIDITY DURING TRANSPORTATION AND ERECTION, WAS NOT EFFECTIVE IN INSULATING AGAINST NOISE TRANSMISSION.
KEYWORDS. ACOUSTIC INSULATION, PREFABRICATED BUILDINGS, WOOD CONSTRUCTION.

HARRIS, A. S. 11 71209
ALASKA-CEDAR. (REV.)
USDA AM. WOODS FS-224, 7 P., ILLUS.
A NONTECHNICAL DESCRIPTION OF THE DISTRIBUTION, CHARACTERISTICS, AND USES OF THE TREE AND ITS WOOD.
KEYWORDS. CEDAR, ALASKA

HENLEY, JOHN W. 07 72072
GRADING SUGAR PINE SAW LOGS IN TREES.
USDA FOREST SERV. RES. PAP. PNW-132, 8 P., ILLUS.
A STUDY OF SURFACE CHARACTERISTICS AND LUMBER RECOVERY INFORMATION OBTAINED FOR 426 LOGS FROM 64 TREES INDICATES THAT PROBLEMS ENCOUNTERED IN APPLYING A LOG GRADING SYSTEM TO SUGAR PINE TREES CAN BE ALLEVIATED BY MODIFICATIONS IN THE SPECIFICATIONS. THE MODIFICATIONS DO NOT APPEAR TO DECREASE THE PERFORMANCE OF THE GRADING SYSTEM.
KEYWORDS. SUGAR PINE, LOG GRADES.

OVIATT, A. E. 03 72009
MOISTURE IN WOOD STRUCTURES FOR ICE SKATING.
FOREST PROD. J. 22(3), P. 50-54, ILLUS.
CONDENSATION ON INTERIOR SURFACES IS A SPECIAL PROBLEM IN INDOOR SKATING RINKS, WHERE TIMBER FRAMING SYSTEMS ARE WIDELY USED. TWO RINK BUILDINGS OF DIFFERENT TYPES ILLUSTRATE THE CONTROL OF CONDENSATION BY VENTILATION, INSULATION, DEHUMIDIFICATION, AND HEATING.
KEYWORDS. HUMIDITY, CONDENSATION, CONSTRUCTION MATERIALS.

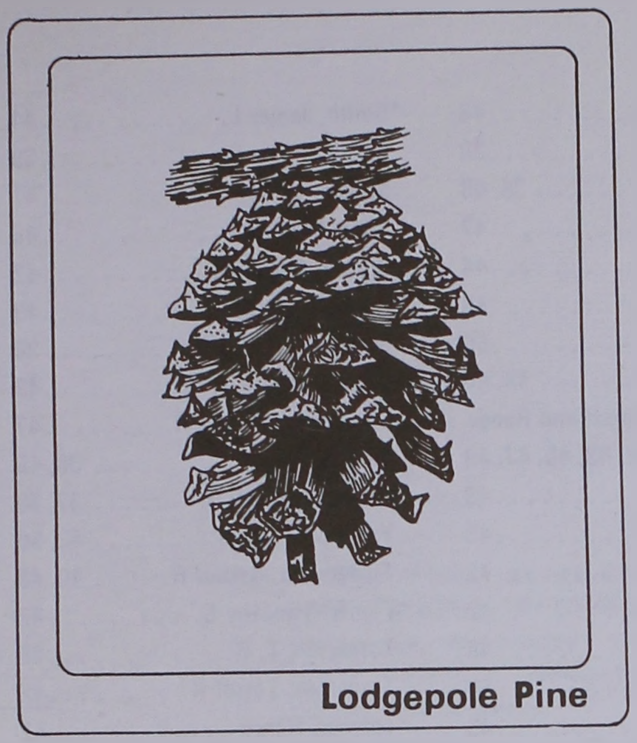
*ROSNER, ARNOLD S. 5 72078
SYSTEMS'S ROOTS--BRITAIN'S EXPERIENCES SPAN 25 YEARS.
AM. SCH. AND UNIV., 44(9), P. 17.
SCHOOL DISTRICTS IN GREAT BRITAIN COOPERATE TO SAVE TIME AND EXPENSE IN CONSTRUCTING NEW SCHOOL BUILDINGS. THE BRITISH CONSORTIA (COOPERATING DISTRICTS) ACHIEVE ECONOMIES THROUGH SUCH ACTIONS AS, (1) PURCHASING MATERIALS IN BULK, (2) ADOPTING A BUILDING SYSTEM, AND (3) CONTRACTING SERIALLY.
KEYWORDS. SCHOOL BUILDINGS, CONSTRUCTION ECONOMICS.

RUTH, ROBERT H., AND CLYDE UNDERWOOD* 02 72091
MAPLE SIRUP IN OREGON. (ABSTR.) 'IN' PROCEEDINGS OF THE EIGHTH CONFERENCE ON MAPLE PRODUCTS.
AGRIC. RES. SERV., U.S. DEP. AGRIC., ARS 73-73 (EMN PUBL. NO. 3618). (NO COPIES AVAILABLE)
BIGLEAF MAPLE PRODUCED GOOD SAP FLOWS BUT THE SAP WAS LOW IN SUGAR CONTENT AND THE SYRUP ONLY FAIR TO POOR IN PRESENCE OF TYPICAL MAPLE FLAVOR.
KEYWORDS. MAPLE SYRUP, 'ACER MACROPHYLLUM,' BIGLEAF MAPLE, OREGON.

RUTH, ROBERT H., J. CLYDE UNDERWOOD,* 6 72089
CLARK E. SMITH, AND HOYA Y. YANG*
MAPLE SIRUP PRODUCTION FROM BIGLEAF MAPLE.
USDA FOREST SERV. RES. NOTE PNW-181, 12 P., ILLUS.
BIGLEAF MAPLE SAP FLOW DURING THE 1970-71 SEASON RANGED FROM NONE TO 16.9 GALLONS PER TAPHOLE AND SUGAR CONTENT OF THE SAP FROM 1.0 TO 2.6 PERCENT. THE SIRUP WAS VERY FLAVORFUL, AND SIRUP PRODUCTION APPEARS QUITE FEASIBLE AS A HOBBY.
KEYWORDS. MAPLE SUGAR, BIGLEAF MAPLE, 'ACER MACROPHYLLUM,' SAP.

*WESTERN WOOD PRODUCTS 12 72214
WOOD FRAME WALLS, FLOORS FOR SOUND INSULATION.
CAT. K SOUND CONTROL, P. K/3, ILLUS.
THE WALL AND FLOOR CONSTRUCTIONS ILLUSTRATED IN THIS BROCHURE HAVE BEEN TESTED AND RATED FOR SOUND INSULATION BY RECOGNIZED ACOUSTICAL LABORATORIES. THEY PERMIT SELECTION OF A WALL OR FLOOR CONSTRUCTION TO PROVIDE A DESIRED LEVEL OF SOUND INSULATION AND FIRE RESISTANCE AT REASONABLE COST.
KEYWORDS. ACOUSTIC INSULATION, WALLS, FLOORS, WOOD-FRAME CONSTRUCTION.

WOODFIN, RICHARD O., JR., AND W. Y. PONG 11 72208
DRY VENEER VOLUME LOSSES IN PRODUCTION OF RED AND WHITE FIR PLYWOOD.
USDA FOREST SERV. RES. NOTE PNW-191, 12 P.
LOSSES OF ROUGH, DRY VENEER BETWEEN DRYING AND PANEL TRIMMING EXPRESSED AS PERCENTAGES PROVIDE A MEANS TO ESTIMATE OUTPUT FROM DRYER PRODUCTION VOLUMES. APPROXIMATELY 16 PERCENT OF THE DRY VENEER VOLUME WAS LOST DURING PRODUCTION OF PLYWOOD.
KEYWORDS. VENEERS (RECOVERY), PLYWOOD, 'ABIES MAGNIFICA,' RED FIR, 'ABIES CONCOLOR,' WHITE FIR.



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